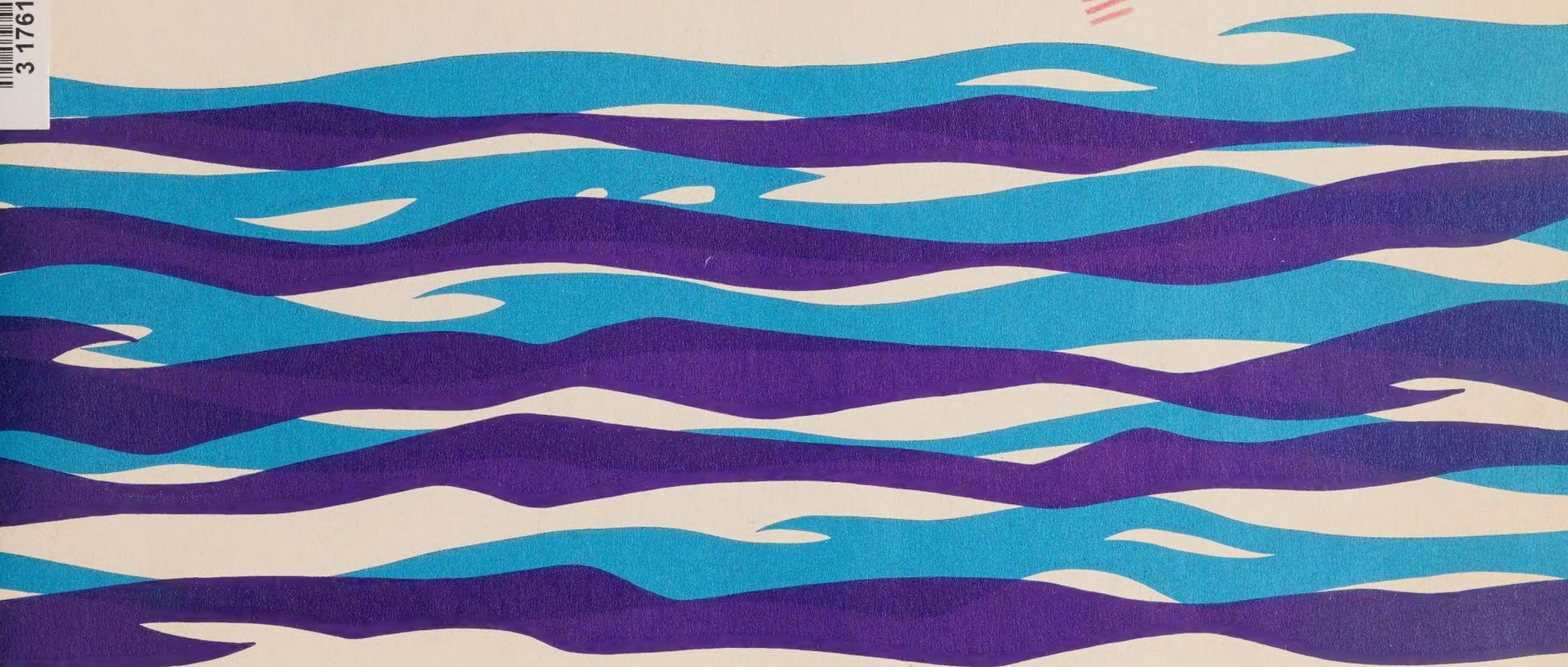


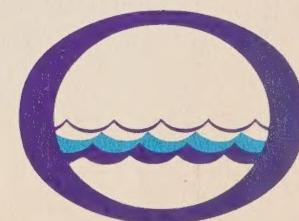
CAZ DN
WR
A56

31761116495631

1967 ANNUAL REPORT



ONTARIO WATER RESOURCES COMMISSION



Water Management in Ontario



Digitized by the Internet Archive
in 2023 with funding from
University of Toronto

<https://archive.org/details/31761116495631>

CAZON
NR
-A 56

**TWELFTH
ANNUAL REPORT
ONTARIO WATER RESOURCES
COMMISSION
1967**





ONTARIO WATER RESOURCES COMMISSION
801 BAY STREET, TORONTO 5
OFFICE OF THE GENERAL MANAGER

March 31, 1968.

Dr. James A. Vance,
Chairman,
Ontario Water Resources Commission,
801 Bay Street,
Toronto 5, Ontario.

Dear Sir:

It is with pleasure that I present to
you and the other members of the Ontario Water
Resources Commission the Twelfth Annual Report
of the Commission.

You're sincerely,

J. A. Vance
General Manager.



ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE CHAIRMAN

March 31, 1968.

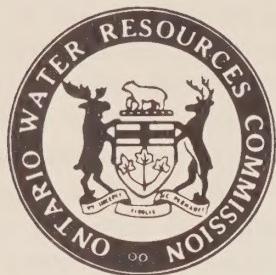
To the Honourable J. R. Simonett,
Minister of Energy and Resources Management.

Sir,-- I have the honour to present for your
approval the Twelfth Annual Report of the
Ontario Water Resources Commission, made in
conformity with and under provisions of The
Ontario Water Resources Commission Act.

Respectfully submitted,

James A. Vance
Chairman.

Ontario Water Resources Commission 1967



Dr. J.A. Vance Chairman
J.H.H. Root Vice Chairman

Commissioners
H.E. Brown, W.D. Conklin, Q.C.,
L.E. Venchiarutti, D.A. Moodie

D.S. Caverly General Manager
W.S. MacDonnell Commission Secretary

STAFF ORGANIZATION AS OF DECEMBER 31, 1967

GENERAL MANAGER D.S. Caverly

ASSISTANT GENERAL MANAGERS L.E. Owers, K.H. Sharpe, F.A. Voege, A.K. Watt

COMMISSION SECRETARY W.S. MacDonnell

ASSISTANT TO THE GENERAL MANAGER M.J. Cathcart

ADMINISTRATIVE BRANCHES

INFORMATION: INFORMATION OFFICER J.C. Scott

LEGAL: SENIOR SOLICITOR H. Landis

PERSONNEL: PERSONNEL DIRECTOR A.R.W. Uren

DIVISION OF ADMINISTRATIVE SERVICES

L.M. Tobias Director

DIVISION OF CONSTRUCTION

A.W. Shattuck Director J.C.F. MacDonald Assistant Director

DIVISION OF FINANCE

E.F. Heath Comptroller and Director

DIVISION OF INDUSTRIAL WASTES

D.P. Caplice Director H.A. Clarke Assistant Director

DIVISION OF LABORATORIES

J.H. Neil Director

DIVISION OF PLANT OPERATIONS

D.A. McTavish Director C.W. Perry Assistant Director

DIVISION OF PROJECT DEVELOPMENT

P.G. Cockburn Director L.F. Pitura Acting Assistant Director

DIVISION OF RESEARCH

A.J. Harris Director

DIVISION OF SANITARY ENGINEERING

J.R. Barr Director G.R. Trewin Assistant Director

DIVISION OF WATER RESOURCES

K.E. Symons Director D.N. Jeffs Assistant Director

Contents

INTRODUCTION	1
INFORMATION BRANCH	2
LEGAL BRANCH	4
PERSONNEL BRANCH	5
DIVISION OF ADMINISTRATIVE SERVICES	6
SYSTEMS AND E.D.P. BRANCH	7
PROCUREMENT BRANCH	8
DIVISION OF CONSTRUCTION	10
DIVISION OF FINANCE	21
BALANCE SHEET	22
DIVISION OF INDUSTRIAL WASTES	23
FIELD SERVICES BRANCH	23
DESIGN APPROVALS AND SPECIAL PROJECTS BRANCH	28
DIVISION OF LABORATORIES	31
BACTERIOLOGY BRANCH	33
BIOLOGY BRANCH	35
CHEMISTRY I BRANCH	39
CHEMISTRY II BRANCH	42
DIVISION OF PLANT OPERATIONS	44
DIVISION OF PROJECT DEVELOPMENT	51
PROJECTS BRANCH	51
PROPERTY BRANCH	54
DIVISION OF RESEARCH	55
APPLIED SCIENCES BRANCH	55
TECHNICAL ADVISORY SERVICES BRANCH	60
SPECIAL STUDIES BRANCH	62
DIVISION OF SANITARY ENGINEERING	64
DESIGN APPROVALS BRANCH	65
DISTRICT ENGINEERS BRANCH	68
WATER QUALITY SURVEYS BRANCH	70
PLUMBING AND BOATING BRANCH	73
REGIONAL SERVICES PLANNING BRANCH	73
DIVISION OF WATER RESOURCES	75
SURVEYS AND PROJECTS BRANCH	76
WATER AND WELL MANAGEMENT BRANCH	80
HYDROLOGIC DATA BRANCH	86
RIVER BASIN RESEARCH BRANCH	90

Introduction

The consolidation of existing programs characterized the work of the Ontario Water Resources Commission during 1967. With the economic and social developments which are occurring within the Province at the present time, the Commission's responsibility for the provision of adequate water supplies and the control of pollution assumes an ever increasing degree of importance.

The promotion of treatment facilities throughout the Province continues to receive close attention. The number of municipalities with unsatisfactory waste treatment facilities is becoming progressively smaller. The Commission's direct involvement in the provision of such facilities was greatly expanded during 1967 under the system of provincial financing introduced in 1965. As of December 31, 1967, 190 provincial programs were in various stages of development at an estimated value of \$141.5 million as compared with a total of \$61 million at the end of 1966. Emphasis continues to be placed upon long range planning and the carrying out of regional studies pertaining to water supply and sewage treatment needs. Seventeen such programs are being developed in various areas of the Province.

Emphasis was placed by the Commission's field staff on a wide coverage of industrial installations in 1967 with respect to waste treatment and disposal practices. Increasing numbers of industries have installed, or are in the process of installing, waste treatment facilities within their plants or are making arrangements for the treatment of such wastes in municipal treatment facilities. Sixty-five certificates for industrial waste control facilities were issued to industries during the year, involving the expenditure of over \$11 million.

The Commission's regular water quality control program was highlighted during the year by the announcement of a new policy regarding water quality objectives. These objectives represent an approach to waste treatment more closely related to the particular uses which are being made of a watercourse, having regard to its present and future uses as well as its self-purification capacity. While the present water quality objectives of the Commission will undergo little change, technical advances in the field of pollution control have made it possible to more accurately predict the effect which specific wastewater discharges will have on a particular body of water and it is the quality of these discharges, therefore, which will be primarily affected by the new OWRC policy.

A water quality study of particular importance commenced during 1967 on the Ottawa River. This major study is being carried out in co-operation with the Quebec Water Board and will include a determination of existing water quality conditions as well as recommendations for future river uses.

The Great Lakes Water Quality Survey has been intensified. Progress on the lower lakes inventory in co-operation with the International Joint Commission was sufficiently advanced during the year that it was possible to enlarge the survey program to permit more intensive lake investigations being carried out in line with the new water quality objectives. The program employed six vessels in investigating water quality and wastewater diffusion, especially in harbour areas and areas of heavy water use. Approximately 100 members of staff are involved in this program, including the technologists aboard the survey vessels, laboratory personnel in London and Toronto, computer experts and the scientists and engineers who evaluate the data and co-ordinate the program.

Studies of the water resources of the five major drainage basins of the Hudson Bay - James Bay area were continued. General hydrologic investigations were carried out through the entire region. Close co-operation was maintained with the Federal Department of Transport and the Department of

Energy, Mines and Resources with respect to the development of hydrometric networks. Twenty-four streamflow gauging stations were operated co-operatively with the Federal Government during 1967. This survey will be carried on for a considerable period of time in order that a comprehensive picture may be obtained of the water resources of this vast northern region.

Other programs of the Commission continued to move forward. The progress which has been made is reflected in the more detailed account of the Commission's activities which is given in the following pages of this Report.

Information Branch

JOHN C. SCOTT Information Officer

During 1967, attention continued to be focussed by the Information Branch upon all facets of the various activities which make up the Ontario Water Resources Commission's program.

This program was highlighted for the general public through the Branch's regular Information Service supplied to all media in the Province such as newspapers, TV, radio and trade and other publications. The Branch's photographic section produced a one-minute "commercial" for TV use - the theme: "clean water". This was a first-time venture.

An expanded outdoor billboard "clean water" advertising campaign received acclaim when the poster design used on billboards throughout Ontario received an award in the Second Annual Competition for Canadian Outdoor Advertising Design. The poster won third place in the Public Service Displays category.

Complementary activities included an enlarged program in the display advertising field, production of new publications



OWRC Float in Etobicoke Centennial Parade, July 1st, 1967. The "Clean Water" message was part of the Borough's national birthday celebration.

and posters, and large-scale distribution of both these and previously produced items. A distinctive OWRC bookcover was a popular new feature with school teachers and students.

In the matter of publications, a start was made in making all such OWRC productions more uniform in appearance and in size. In addition, a program was initiated in an effort to make everyone acquainted with a new OWRC symbol, the original design of which was a creation of a member of the Information Branch staff.

The Branch's exhibits section planned, designed and exhibited a large portable display which was presented at the North Bay Northern Ontario Sportsman's Show, the Home and Sportsman's Show at Orillia, the Leamington District Agricultural Society Fair, the Peterborough Exhibition, Ottawa's Central Canada Exhibition, London's Western Fair, the Markham Agricultural Fair, the Erin Agricultural Fair and Toronto's Royal Agricultural Winter Fair.

Smaller exhibits were on display at the Ontario Federation of Anglers and Hunters Convention in Sudbury, the Tobacco Growers' Trade Fair at Tillsonburg, the Oakville Centennial Exhibition, and at the Water Well Drillers' Conference in Kingston. A float was prepared for the Borough of Etobicoke's July 1st Centennial parade.

The majority of these shows were manned by Branch personnel with help from staff of various Commission divisions.

The exhibits section also participated in the planning and design of the Commission's major display in the Ontario Government Building at Toronto's Canadian National Exhibition. Small portable display materials were made available on request to various organizations.

The same Branch personnel also planned and staged an official opening for the OWRC-municipal water supply system for the community of Warkworth, located in the Township of Percy in the County of Northumberland and Durham.

An effort was made to include items of broad interest to Ontario residents in Information Service bulletins in order to maintain media interest and increase the effectiveness of this phase of Information Branch activities.

Because more and more persons are becoming concerned with recreational water use, more stress was placed on OWRC activities in resort areas of the Province. This type of story, in feature and straight news form, proved popular with the press, as did more general information concerning future Commission programs and the results of studies and reports. OWRC research activities proved particularly popular.

Wide coverage was given releases concerning an 18-foot high-speed runabout used in Great Lakes survey work, tightening of OWRC water quality objectives, the opening of a branch office in Kingston, installation of a robot quality monitoring device in the St. Clair River and the OWRC discovery of a new use for a mosquito killer in the control of black flies.



The OWRC's "Clean Water" campaign was carried out with the aid of posters and billboards, which were placed in nearly every part of Ontario. Here, two Ontario citizens "get the message".

An effort was made also to reinforce important releases with follow-up stories. The new water quality objectives policy, the Great Lakes program and the Boating Regulation, which deals with the disposal of sewage and other wastes from pleasure boats, were among programs treated in this way.

In all, 134 items were carried by the Information Service. Many were routine in nature and concerned such matters as steps taken by industry to control pollution, OWRC official statements, construction contract awards, various Commission water supply and pollution control projects and other activities including abstracts from important speeches by commissioners and members of senior staff.

One major function of the staff magazine, OWRC NEWS, in 1967 was the supplying of information to staff concerning

the conversion to electronic data processing within the Commission. This campaign was climaxed by a special edition dealing thoroughly and factually with the situation. There were four issues of the magazine in 1967.

The photographic section was most active during the year and completed filming for an OWRC-produced motion picture "The Invisible River". Editing of the workprint was in progress as the year ended and the film itself was expected to be ready for showing by early summer. Its subject, water by pipeline, features the Commission's Lake Huron Water Supply System. In addition, the Branch started building a small library of pertinent 16mm. motion pictures.

The Branch photographer also handled all still photography assignments for the Commission and supplied pictures to back up major news releases.

Interest in OWRC publications continued with the demand increasing appreciably during 1967. Teachers and students are becoming increasingly aware of the availability from the Commission of water resources information which could be used in teaching and studies. There was a steady demand throughout the year, with the peak period coming during the fall exhibits season. For instance, more than 3,000 individual requests were handled from exhibitions alone. In addition to the usual booklets and pamphlets distributed on the exhibition circuit, 80,000 of the new bookcovers were given to students and others.

In addition, Branch office staff handled more than 1,800 individual telephone and mail requests for OWRC material which included circulation of more than 12,000 copies of the "Story of Water", over 10,000 copies of the OWRC brochure and more than 35,000 bookcovers.

New publications during the year included a new waxed poster for outdoor use warning that it is illegal to pollute water and outlining the penalty, a pamphlet explaining the provisions of the new OWRC Boating Regulation and two brochures - "Introduction to Popular Treatment Methods for

Municipal Wastes and Water Supplies", and "Visit to a Water Treatment Plant", a companion piece for the previously published "Visit to a Water Pollution Control Plant".

A special adhesive "clean water" badge was produced for distribution to children at the various OWRC exhibits.

Another first for the Commission was the production and distribution of an attractive "clean water" desk calendar.

The placing of tender call advertisements and advertisements regarding OWRC public hearings continued to be an Information Branch assignment, as was the sale of the Ontario Plumbing Regulation.

Legal Branch

H. LANDIS Senior Solicitor

During the year the Legal Branch provided to the Commission a general advisory service that was as varied as the diverse functions of the Commission. Of special interest was the responsibility of the Branch for the implementation of the Commission's policy toward industrial and commercial concerns that fail to install adequate waste treatment facilities.

Convictions were recorded upon 13 counts for impairing the quality of the water of watercourses, contrary to Section 27(1) of the Act, against 10 companies, including a distillery, four canning plants, three fabricating plants, a rendering plant and a cheese factory. In one case the manager of a private company was also charged and convicted. In addition, a railway company was convicted of discharging oil into a river. One prosecution involving discharge from a mobile tank wagon was dismissed but was under appeal at the end of the year. An injunction obtained against a mining concern was withdrawn when remedial measures were taken. Two con-

victions were recorded for breach of the well drilling regulations.

The Legal Branch also prepared and arranged the service of requirements and directions of the Commission upon two companies under Sections 30 and 50 of the Act.

A number of amendments to the Plumbing Regulation were made during the year.

Personnel Branch

A.R.W. UREN Director

A new era in employer-employee relations was entered in 1967 following the passage of amendments to the Public Service Act of 1966, which extended bargaining rights of The Civil Service Association of Ontario to include employees of Crown agencies including those of the Ontario Water Resources Commission. The initial phase of negotiation to establish management exclusions had almost been concluded as the year ended.

Recruitment and associated activities resulting from sustained growth continued to place a major demand on the Branch.

More advance planning and improved publicity contributed to a higher measure of success in recruitment. Objectives for new staff recruitment continued to place emphasis on engineering, scientific and technical skills, in addition to the associated demand for administrative and clerical skills. Maritime occupations, first introduced with the Great Lakes Program during 1965, increased the demand during 1967 for personnel with nautical experience.

The major universities of Canada and several provincial institutes of technology were visited during a comprehensive graduate recruiting program. Recruiting teams comprising

senior representatives of personnel and professional staff visited a total of 23 Canadian universities and six provincial technological institutes over a period of 15 weeks. A total of 423 students applied for interviews; 88 of these were selected for secondary interviews and 43 accepted offers of employment. Although many of the Commission's immediate needs for staff are met at the graduate level, other avenues are also explored.

A growing interest from students in co-operative engineering and scientific courses has been stimulated by campus publicity and visits. Students in these co-operative courses have been employed on recurring work terms during their courses with highly satisfactory results. A total of 19 such students each served one work term of four months and four served for two work terms. Their employment encourages interesting prospects for the future.

Staff requirements in the Commission for secondary school graduates are modest in number. Nevertheless, some secondary school guidance departments were provided with material describing career opportunities with the Commission.

Continuous contact is maintained with Canada Manpower Centres in Toronto and elsewhere. The Branch has participated in wage and salary surveys as well as manpower planning surveys.

An aggressive advertising program has been carried on and space has been used in the Canadian Careers Directory and in the College Placement Annual.

A significant number of employees associated with field and plant operations activities received immunization through the co-operation of the health service in Toronto and local health units elsewhere in the Province.

The Branch organized a two day first-aid training course for selected field staff. The candidates were examined by the St. John's Ambulance staff. The entire class of ten successfully completed the examination.

The bursary program of graduate training, administered

by the Branch, provided grants and educational leave to ten members of staff. Six are studying sanitary engineering, two hydraulic engineering, one hydrology and one oceanography. Fifty-seven members of staff applied for financial assistance to undertake supplementary training directly related to their occupation through university extension courses, secondary school evening courses, approved correspondence courses and at technological institutes. Candidates who successfully complete approved courses are reimbursed 50 per cent of the cost. Complete results for the year 1967 will not be known until all spring term work is completed. Of the 44 applications received from staff during 1966, 34 completed their course and qualified for reimbursement, representing a completion rate of 77 per cent.

On December 31, 1967, the staff complement of the Commission was:

HEAD OFFICE ORGANIZATION:

Permanent and Temporary	669
Casual and Seasonal Casual	44

PROVINCIAL WORKS

Permanent	20
Casual	2

PLANT OPERATIONS

Permanent and Temporary	239
Regular Part-Time	20
Casual	20

DIVISION OF ADMINISTRATIVE SERVICES

L.M. TOBIAS Director

The Division was officially formed in April, 1967, and comprises three main branches: Systems and Electronic Data Processing, Procurement, and Central Records. The Systems and E.D.P. Branch is responsible for assessing existing adminis-



A telephone data set and a modern Computer Terminal enables programmers to communicate with large computing facilities.

trative procedures and recommending methods for improved efficiency. It also is responsible for the co-ordination and control of the Commission's computer development, designing the necessary systems and writing the computer programs. The Procurement Branch comprises three sections: Purchasing, Stores, and Inventory Control. It is, therefore, responsible for providing, storing, distributing and controlling the goods, equipment and services required in the performance of Commission programs. The Central Records Branch is responsible for maintaining the correspondence, reports and documents of the Commission.

The re-organization which resulted in the formation of the Division brought together some of the administrative functions previously spread out through the Commission. Considerable progress has been made in streamlining some internal procedures while the Systems and E.D.P. activities have grown

to the point where it is recognized that the need for accurate, organized data in large volumes can no longer be met by manual methods. Further, the growth of the Commission's technical program has resulted in the need for collection and interpretation of data not previously available. The system of maintaining files was developed at the time the Commission was formed; however, the overall growth required a re-organization of the filing system. This reorganization is now being carried out.

Systems and E.D.P. Branch

With the expansion of the Commission as a whole, and especially in the scope of its technical programs, greater demands have been placed on the service groups. Of particular significance is the advent of computing facilities which have necessitated considerable change in the methods and systems previously used to handle information. The concepts involved are not simple, resulting in the need for training at all levels.

During 1967, the Systems and E.D.P. Branch recruited a number of computer programmers and systems analysts in order to commence work on the development of programs and systems which will lead to the conversion of many Commission information systems from a manual to an automated basis.

With the growth in Branch staff during the year an extensive program of staff development was undertaken. Courses of study were arranged through educational institutions, equipment and supply companies and the Training and Development Branch of the Department of Civil Service.

Programs were developed to process automatically data obtained from a number of studies, while ensuring that such programs would be compatible with the long range objective of an integrated Management Information System for the Commission:

As a result of an updating of the computing facility to be installed at the Department of Highways, a re-assessment of

the Commission's computer specifications was made, with recommendations on the type of computing facility that would most adequately serve the needs of the Commission while, at the same time, taking full advantage of the facility to be available at the Department of Highways. A terminal-type computer is felt to be best suited to the Commission's present needs and the final selection as to type and size should be decided early in 1968.

During the year the Branch established a Data Centre to key-punch data arriving from the operating divisions and to provide the necessary means of developing and testing programs at an accelerated rate through the use of an I.B.M. Quiktran Terminal.

A number of studies of an administrative nature were commenced or further developed by the Branch during the year, the major ones being Central Records and Procurement.

Working with the Records Management Consultants, hired by the Ontario Government, the record-keeping systems of the Commission have been revised and modernized. This program should continue for most of 1968 at which time the new systems should be fully implemented enabling Central Records staff to maintain and update the system as required.

As a result of the organization study carried out in 1966 resulting in the establishment of the Procurement Branch, a further study was in progress to develop systems and procedures which should enable that Branch to improve the level of service to the various operating divisions of the Commission.

During the year a considerable amount of time has been devoted to the ever-increasing needs of the Commission for additional space. A ten-year forecast of the Commission's staff and space requirements was developed.

In 1968 it is expected the required computing facility will be installed and programs now under development will become operational. This will form the nucleus of a streamlined Management Information System.

Procurement Branch

Purchasing — Through a revised system of issuing contracts and bulk purchase orders introduced during the year, it was possible to reduce the frequency of placing orders, increase the efficiency of deliveries and simplify the invoice payment procedures.

Statistics for the year reflect an increase in the number of orders processed and issued due to an increase in Ordinary Vote funds. The increase in the number of Commission water and sewage projects, and, especially, the opening of the Lake Huron Water Supply System, contributed to a general 25% increase in workload to serve the projects. This is reflected in a comparison of the operating expenditures:

VOTE	PURCHASE ORDERS RELEASED	VALUE
ORDINARY	5426	\$1 43 MILLION
OPERATING	5094	\$3 22 MILLION
CAPITAL	598	\$4 6 MILLION

Stores — Laboratory — As a result of the large increase in the number of samples received, difficulties encountered with express delivery times, and the "perishable" nature of samples, new handling and transportation methods are being implemented. An overall increase of 29% over last year in the number of samples received is noted.

Total cost of express shipping and receiving on water samples rose 67% due to an increased volume in samples and a rise in express tariff rates. To reduce costs, shipments for a six-month supply are being sent and sample bottles are returned by mail.

During the course of the year 300 wooden shipping containers were added to circulation and shipping volumes have increased by 10% over last year.

The glassware washing function was transferred from the Division of Laboratories to the Division of Administrative Services on May 1, 1967. A new method of machine-sealing sterile bottles was introduced. This trebled the speed of hand-sealing previously employed. Similarly, a new electric labelling machine improved output.

The turnover rate of 400 stocked chemicals increased by 30%. Thirty fast-moving chemicals were placed on a contract delivery basis and a consolidated order was issued for mercury. This simplified stockkeeping records and reduced paperwork.

A physical inventory at the London laboratory was carried out on February 3rd and Laboratory staff received written instructions on shipping and receiving procedures.

A physical inventory of office furniture was conducted in June and spot checks were made on items such as boats, trailers, microscopes, typewriters, incubators, photographic and projection equipment. The equipment inventory increased to about 2,500 pieces.



Stockroom – Statistics:

	1965	1966	1967
PARCELS (OUTGOING)	1,043	995	3,156
MAIL (INCOMING AND OUTGOING)	118,925	150,835	198,741
INCOMING SHIPMENTS	1,337	1,682	2,033
ITEMS REQUISITIONED	4,414	10,332	13,095
DENNISON COPIES (5 COPIERS)	217,057	329,970	606,010

All sections of the Stockroom indicated increased activity during the past year. Services provided included receiving shipments of materials and equipment, receiving and distribution of mail, office supplies stock control, the servicing of copying machines, moving furniture and operating a limited messenger service.

A catalogue of supplies was completed. Stock data were transferred to stock cards and stock was relocated to correspond. New and more efficient mailroom equipment has been ordered to cope with increased mail volume and to provide better service.

Inventory Control – Early in the 1967 fiscal year this section became engaged in invoice verification on Ordinary Vote purchases. Previously, this was the responsibility of the Division of Finance. In addition, Inventory Control assumed the task of setting up and maintaining inventory on Ordinary Vote equipment and consumable supplies.

A newly devised "Weekly Shipping/Receiving Report" is undergoing a trial period in one of the regions of the Division of Plant Operations to determine its suitability for all projects. Information received to date indicates promising results.

Central Records

During the year, much effort and time has been spent in converting the filing system to a more modern and efficient system. In cooperation with the Records Services Branch of the Government and the Records Management Consultant a complete inventory was taken, a study of existing methods was made, and a program for revision was designed.

A considerable volume of documents has been transferred to the Records Retention Centre in Cooksville. All file folders have been examined, regrouped where necessary, and duplicate records eliminated. New equipment has been installed to replace many filing cabinets; this provides much faster access to material and permits easier coding. A manual of procedures for all users, explaining the structure of the new system and its method of operation, was in the final draft stages, and will be issued early in the new year.

Preliminary planning was commenced to establish a retention and disposal schedule; however, this still has to be co-ordinated with the Records Services Branch. The overall task of system conversion will continue in 1968. To date the conversion is keeping pace with the planned schedule.

DIVISION OF CONSTRUCTION

A.W. SHATTUCK Director J.F.C. MACDONALD Assistant Director

During 1967 the Commission entered into 35 contracts valued at \$20,140,210.92 of which \$5,557,601.38 was for water works and \$14,582,609.54 was for sewage works.

During the year 40 contracts were completed. These had a total value of \$26,392,330.77 and consisted of 23 water works totalling \$18,579,772.05 and 17 sewage works at \$7,812,558.72.

Arthur (67-S-230)

DESCRIPTION OF PROJECT: Sanitary sewers (extension).
CONSULTING ENGINEERS: Philips & Roberts Ltd., Burlington.
EXPECTED COMPLETION DATE: July 1968.
ESTIMATED PROJECT COST: \$47,044.00.

The contract was executed December 19, 1967. It is anticipated that work will be commenced early in 1968.

Bancroft (66-S-207)

DESCRIPTION OF PROJECT: 4,180 lineal ft. of sanitary sewer 8" and 10" diameter as extension to the existing system.
CONSULTING ENGINEERS: McAlpine & Bews, Bancroft
COMPLETED: July 12, 1967.
FINAL PROJECT COST: \$60,359.19.

The municipality installed the sewers with its own work force commencing November 18, 1966, and completing the project in July 1967.

Beeton (SP-66-6 & 67-S-220)

DESCRIPTION OF PROJECT: Sewerage system including sanitary sewers, services, pre-fabricated pumping station, forcemain and lagoons.
CONSULTING ENGINEERS: Triton Engineering Services Ltd., Brampton.
ESTIMATED PROJECT COST: \$380,000.00.

Tenders were opened on December 15, 1967.

Big Bob River Water Supply System (WP-66-6)

DESCRIPTION OF PROJECT: Water treatment plant and intake.
CONSULTING ENGINEERS: Canadian Mitchell Associates Ltd., Bramalea.
EXPECTED COMPLETION DATE: October 29, 1968.
ESTIMATED PROJECT COST: \$225,000.00.

Tenders were re-called and were opened on October 17, 1967. The lowest tender was submitted by Gaffney Construction Co. Ltd. to whom the contract was awarded in November 1967. Work will commence February 1968.

Black River (64-S-168)

DESCRIPTION OF PROJECT: Sanitary sewers and lagoon.
CONSULTING ENGINEERS: Sutcliffe Co., New Liskeard.
COMPLETED: October 23, 1967.
FINAL PROJECT COST: \$36,500.00.

The system was placed in operation on October 23, 1967.

Brampton (66-W-166)

DESCRIPTION OF PROJECT: 16 inch diameter watermains.
CONSULTING ENGINEERS: W.O. Chisholm & Associates
Ltd., Scarborough.
COMPLETED: August 29, 1967.
FINAL PROJECT COST: \$102,000.00.

Construction started on June 14th and was completed on August 29th, 1967, well ahead of schedule.

Brampton/Chinguacousy (65-S-184)

DESCRIPTION OF PROJECT: 3 O.M.G.D. extension to sewage treatment plant.
CONSULTING ENGINEERS: Proctor & Redfern, Toronto.
COMPLETED: March 1, 1967.
FINAL PROJECT COST: \$1,496,000.00.

Work on the extension started in September 1965 and was completed on March 1, 1967. The contractor had been granted an extension of time to December 24, 1966, but was unable to meet that date.



The raw pumping station (10 M.I.G.D. capacity) of the Lake Erie Water Supply System, located about two miles east of Port Stanley.

Cache Bay (63-W-121)

DESCRIPTION OF PROJECT: Gravity water supply system consisting of an intake, 6" diameter feeder main, screen chamber, chlorination station, watermains and service connections.
CONSULTING ENGINEERS: R.S. MacLennan, North Bay.
COMPLETED: June 15, 1967.
FINAL PROJECT COST: \$232,293.31.

Chatham (62-S-102 & 65-S-186)

DESCRIPTION OF PROJECT:
CONTRACT 1 — Sewage treatment plant. Final contract cost — \$1,479,430.00.
CONTRACTS 2 TO 10 — Trunk sewers, interceptor sewers, forcemains and pumping stations. Final contract cost — \$2,982,976.00.
CONTRACT 11 — Aerated lagoon, industrial waste. Est. contract cost — \$444,000.00.

CONSULTING ENGINEERS: Todgham & Case Ltd., Chatham. Gore & Storrie Ltd., Toronto.

COMPLETED: Contracts 1 to 10 — Before or during 1966.
EXPECTED COMPLETION DATE:

Contract 11 — Early 1968.

ESTIMATED PROJECT COST:
\$5,430,000.00.

Completion of Contract 11 has been delayed due to late delivery of prefabricated pumping station.

Cornwall (66-S-214)

DESCRIPTION OF PROJECT:
CONTRACT 9 — Northern trunk sanitary sewer, Part I. Est. contract cost — \$360,000.00.

CONTRACT 10 —Pitt St. combined relief sewer. Final contract cost — \$417,000.00.
CONTRACT 11 —Third St. West combined relief sewer. Est. contract cost — \$65,000.00.
CONTRACT 12 —Twelfth St. sanitary sewer. Est. contract cost — \$48,000.00.
CONTRACT 13 —Brookdale Ave. combined relief sewer. Est. contract cost — \$489,000.00.
CONTRACT 14 —Northern trunk, sanitary sewer, Part II. Est. contract cost — \$275,000.00.
CONTRACT 16 —Baldwin Ave. storm relief sewer. Est. contract cost — \$208,000.00.

CONSULTING ENGINEERS:

Gore & Storrie Ltd., Toronto.

COMPLETED:

Contract 10 — August 8, 1967.

EXPECTED COMPLETION DATE:

Contract 9 and 14 — February 1968.

Contracts 11, 12 and 16 — June 1968.

Contract 13 — October 1968.

ESTIMATED PROJECT COST:

\$2,170,000.00.

All this work is either completed or under construction except for Contract 15, Western sanitary sewer, which was deferred and is to be constructed in 1969.

Durham (63-S-148, 65-S-196 & 66-S-204)

DESCRIPTION OF PROJECT: Sanitary sewers, pumping station, force main and aerated sewage lagoon.
CONSULTING ENGINEERS: M.M. Dillon Ltd., London.
COMPLETED: January 1967.
FINAL PROJECT COST: \$509,000.00.

Ear Falls (WP-67-31 & SP-67-61)

DESCRIPTION OF PROJECT: Construction of municipal facilities.

Contract 1 (cost plus).

CONSULTING ENGINEERS: Proctor & Redfern, Toronto.

The Commission, on behalf of the Department of Municipal Affairs, constructed as the first phase of the Ear Falls Townsite, the following works:

1. A temporary water supply utilizing existing local facilities.
2. Roads, sewers, watermains and service connections to approximately 100 residential lots.
3. A mobile home site for approximately 40 trailers.
4. A temporary sewage settling tank and outfall.
5. A stockpile of granular materials for future use.

The above mentioned works and related facilities were completed in 1967 under a cost-plus contract at a cost of about \$933,000.00. Additional work to complete Contract 1, such as the construction of the permanent water pumping station and intake, is scheduled to be carried out on a cost-plus basis in early 1968.

The estimated total cost of this first phase of the new townsite is \$1,200,000.00.

Fort William (64-S-175)

DESCRIPTION OF PROJECT: Hardisty St. interceptor sewer (3,900 lineal feet of 54" diameter sewer in tunnel).

CONSULTING ENGINEERS: W.L.Wardrop & Associates Ltd., Winnipeg.

COMPLETED: February 15, 1967.
ESTIMATED PROJECT COST: \$950,000.00.

Twp. of Gloucester (Orleans) (66-W-156)

DESCRIPTION OF PROJECT:

- CONTRACT 1 -Two deep wells (reported by Division of Water Resources).
- CONTRACT 2 -One underground water storage reservoir and high lift pumping station. Installation of a water distribution system. Final contract cost-\$431,228.45.
- CONTRACT 3 -Two well pumphouses. Est. contract cost -\$35,000.00.

CONSULTING ENGINEERS:

J.L. Richards & Associates Ltd., Ottawa.

COMPLETED:

Contract 2 – October 15, 1967.

EXPECTED COMPLETION DATE:

Contract 3 – January 1968.

CONTRACT 2 – The contractor commenced work late in 1966 and completed the work in October 1967. The contractor was delayed for about four months because the contractor on Contract 1 had difficulty in obtaining a satisfactory source of ground water. The system has been in operation since December 5, 1967, using gravity flow from the wells to the reservoir on a temporary basis until the two well pumphouses covered by Contract 3 have been completed.

CONTRACT 3 – This contract was awarded on November 29, 1967, and construction commenced without delay. The two pumphouses are expected to be completed and in operation by January 20, 1968.

Haileybury (SP-67-69)

DESCRIPTION OF PROJECT:

Alterations of existing sewers, sewage pumping station, force main, prefabricated pollution control plant, service building and outfall sewer.

CONSULTING ENGINEERS: Hisey & Barrington, Willowdale.

EXPECTED COMPLETION DATE: October 17, 1968.

ESTIMATED PROJECT COST: \$453,500.00.

Work started in the second half of October and by the end of the year the foundation walls of the service building were completed and the reinforcing steel for the treatment tank slab was in place.

Kitchener (59-S-19)

DESCRIPTION OF PROJECT: Water supply extensions to the sewage treatment plant.

CONSULTING ENGINEERS: Proctor & Redfern, Toronto.

COMPLETED: October 13, 1967.

ESTIMATED PROJECT COST: \$42,055.00.

Work commenced on August 21, 1967, and was completed and in operation by October 13, 1967.

Lake Erie Water Supply System (WP-65-2)

DESCRIPTION OF PROJECT:

CONTRACT 1 -Access roadway, sea wall, cofferdam and excavation for low lift pumping station.
Final contract cost – \$1,379,650.00.

CONTRACT 2 -Water intake and plant drain. Est. contract cost – \$1,128,695.00.

CONTRACT 3 -Low lift pumping station at the lake. Est. contract cost – \$821,520.00.

CONTRACT 4 -Terminal reservoir at St. Thomas – 6 million gallon capacity.
Final contract cost – \$745,898.00.

CONTRACT 5A -Supplying, laying and jointing water pipe, specials and accessories for the 30" diameter pipeline from Lake Erie to St. Thomas.
Final contract cost – \$1,765,155.00.

CONTRACT 5B —Supplying, laying and jointing water pipe, specials and accessories for the 30" diameter pipeline in the City of St. Thomas.

Final contract cost — \$403,828.00.

CONTRACT 8 —Booster pumping station substructure. Final contract cost — \$47,445.00.

CONTRACT 9 —Booster pumping station superstructure and equipment. Est. contract cost — \$188,459.00.

In addition, the Commission will supply \$500,000 of mechanical and electrical equipment and a \$120,000 elevated storage tank.

Work involved in the extensions to the existing St. Thomas pumping station, valued at \$380,000, has been excluded from this project.

CONSULTING ENGINEERS:

COMPLETED:

James F. MacLaren, Toronto.
Contract 1 — June 14, 1967.
Contract 2 — Nov. 15, 1967.
Contract 3 — December 1, 1967.
Contract 4 — August 18, 1967.
Contract 5A—Nov. 10, 1967.
Contract 5B—July 31, 1967.
Contract 8 — May 15, 1967.

EXPECTED COMPLETION DATE: Contract 9 — January 1968.

With the exception of the water treatment plant and automatic control devices, the entire system is now in operation.

Lake Huron Water Supply System (WP-64-1)

DESCRIPTION OF PROJECT:

CONTRACT 1 —72" dia. lake intake and 42" dia. plant drain.
Final contract cost — \$2,137,148.00.

CONTRACT 2 —Construction of low lift pumping station at Grand Bend.
Final contract cost — \$1,861,527.00.

CONTRACT 3 —Water treatment plant and high lift pumping station. Final contract cost — \$5,437,481.00.

CONTRACT 4 —Supply and delivery of water pipes, specials and accessories.

Final contract cost — \$4,364,535.00.

CONTRACT 5 —Laying and jointing water pipes, specials and accessories for 48" dia. pipeline. Final contract cost — \$1,747,349.00.

CONTRACT 6 —Construction of terminal reservoir of 12 M.G.D. capacity. Final contract cost — \$1,106,357.00.

CONTRACT 7 —Radio communication system.
Final contract cost — \$65,468.00.

CONTRACT 8 —Landscaping at Grand Bend. Est. contract cost — \$55,000.00.

CONTRACT 9 —Drain at reservoir. Final contract cost — \$104,098.00.

CONSULTING ENGINEERS:

James F. MacLaren Ltd., Toronto.

COMPLETED:

Contract 1 — December 1966. Contract 5 — January 1967.
Contract 2 — May 1967. Contract 6 — January 1967.
Contract 3 — June 1967. Contract 7 — July 1967.
Contract 4 — November 1966. Contract 9 — November 1966.

EXPECTED COMPLETION DATE:

Contract 8 — June 1968.

Estimated cost of construction and engineering —
\$18,125,000.00

Work on Contract 8 (landscaping) was suspended in November in accordance with the contract and will be completed in early summer. The system has been in operation since June 1967.

Lake Simcoe Pollution Control System No. 1 (SP-66-8, 66-S-218)

DESCRIPTION OF PROJECT: Pumping station, force main, lagoon and outfall to Lake Simcoe.
(SP-66-8)

(66-S-218)
CONSULTING ENGINEERS: W.O. Chisholm & Associates Ltd., Scarborough.

ESTIMATED COST OF BOTH PROJECTS: \$630,000.00.

Tenders for both parts of the work were received in July 1967. As the lowest tender submitted was 25% over the consulting engineer's estimate, it was decided to make the necessary arrangements to construct the collector system, also, as a provincially owned project. Tenders are to be re-called as soon as the arrangements are completed.

Little Current (67-S-228)

DESCRIPTION OF PROJECT: Extension to the existing sanitary sewerage system comprising sanitary sewers, manholes and a 6" diameter force main.
CONSULTING ENGINEERS: Kilborn Engineering Ltd., Toronto.
ESTIMATED PROJECT COST: \$62,500.00.

Tenders were opened on December 5th. The contract had not been awarded by the end of the year.

Markdale (66-S-199)

DESCRIPTION OF PROJECT: Sanitary sewers, service connections and lagoon.
CONSULTING ENGINEERS: R.V. Anderson Associates Ltd.
EXPECTED COMPLETION DATE: August 1968.
ESTIMATED PROJECT COST: \$508,000.00.

Work commenced in June 1967 and by the end of the year about 80% of the sewers and services had been laid and about 70% of the work on the lagoon had been completed. Completion of the lagoon had to be deferred after freeze-up until next spring.

Mattawa (66-S-215)

DESCRIPTION OF PROJECT: Extension to the existing sewerage system comprising a collector, service laterals and appurtenances.
CONSULTING ENGINEERS: Sutcliffe Co., New Liskeard.
COMPLETED: November 15, 1967.
FINAL PROJECT COST: \$30,924.00.

Metro. Toronto/Toronto Twp. (Town of Mississauga) (63-S-160)

DESCRIPTION OF PROJECT: First extension to the Lakeview water pollution control plant.
CONSULTING ENGINEERS: Gore & Storrie Ltd., Toronto.
COMPLETED: November 24, 1967.
ESTIMATED PROJECT COST: \$2,043,000.00.

Work started in January 1966 and could have been finished in the beginning of 1967 but union troubles between the mechanical subcontractors and the plumbers delayed the construction considerably. The extension was placed in full operation on November 24, 1967.

Mitchell (66-S-211)

DESCRIPTION OF PROJECT: Sewage lagoon and ancillary works.
CONSULTING ENGINEERS: R.M. Dawson, Stratford.
EXPECTED COMPLETION DATE: May 31, 1968.
ESTIMATED PROJECT COST: \$85,600.00.

Work commenced on July 17, 1967, and was 73% completed by the end of the year. Wet weather delayed the completion of the earthworks, leaving landscaping and minor works to be finished in the late spring.

Moosonee (WP-66-4 & SP-66-2)

DESCRIPTION OF PROJECT:

CONTRACT 1 - Sanitary sewers, storm sewers, watermains and road restoration on First Street.

Final contract cost - \$164,262.32.

CONTRACT 2 - Supplying and stockpiling granular material for construction of sewers, watermains, storm sewers and roadways.

Final contract cost - \$166,745.21.

CONTRACT 3 - Sanitary sewers, storm sewers, watermains and roads. Est. contract cost - \$643,500.00.

CONTRACT 4 - Water works including dam, low lift station and prefabricated water treatment plant, prefabricated sewage treatment plant and two prefabricated sewage pumping stations.

Est. contract cost - \$910,000.00.

CONSULTING ENGINEERS:

Sutcliffe Co., New Liskeard.

COMPLETED:

Contract 1 - July 15, 1967. Contract 2 - March 1967.

EXPECTED COMPLETION DATE:

Contract 3 - June 21, 1968. Contract 4 - August 1968.

ESTIMATED PROJECT COST:

\$2,100,000.00.

Work started in September 1966. During 1966 and 1967 sewers and watermains were installed on several streets. By the end of the year most of the streets were ready to receive the final top layer of granular "A" which will be placed in the spring of 1968.

Excavation for Contract No. 4 commenced in late September 1967 and by the end of the year the concrete foundations for the treatment plants had been poured and sheet piling had been driven for the sewage pumping stations.

Twp. of Mountjoy (65-S-195)

DESCRIPTION OF PROJECT:

Sanitary sewers, service connections, force main and sewage pumping station.

Gore & Storrie Ltd., Toronto.

COMPLETED:

August 1967.

ESTIMATED PROJECT COST:

\$170,000.00.

The project is in limited operation as some of the sewers require cleaning and some need to be corrected. This work will be done in the spring of 1968.

Twp. of Nepean (66-S-206)

DESCRIPTION OF PROJECT:

Construction of a secondary settling tank.

CONSULTING ENGINEERS:

Gore & Storrie Ltd., Toronto.

EXPECTED COMPLETION DATE:

April 1968.

ESTIMATED PROJECT COST:

\$73,543.00.

The contractor submitted his tender on July 26, 1967. The contract was executed on October 10, 1967, and work commenced on October 24, 1967. About 20% of the contract was completed by the end of the year.

Twps. of Nepean, March and Goulbourn (66-S-201)

DESCRIPTION OF PROJECT:

Installation of sanitary trunk sewers serving the above townships.

CONSULTING ENGINEERS:

Butts, Ross, Magwood & Hall Ltd., Ottawa.

ESTIMATED PROJECT COST:

\$348,359.00.

Tenders were received on September 28, 1967, with prices below the preliminary O.M.B. approval. The contract had not been awarded by the end of the year.

New Hamburg (66-S-216)

DESCRIPTION OF PROJECT:	Extensions to existing sanitary sewerage system with additional pumping station and lagoon.
CONSULTING ENGINEERS:	McCargar and Hachborn, Kitchener.
EXPECTED COMPLETION DATE:	April 5, 1968.
ESTIMATED PROJECT COST:	\$324,402.00.

Work commenced on October 11, 1967, and was 28% completed by the end of the year. Work is continuing throughout the winter.

Twp. of Percy (Warkworth) (65-W-148)

DESCRIPTION OF PROJECT:	Construction of a river-water intake, a water treatment plant, a reinforced concrete reservoir and a water distribution system.
CONSULTING ENGINEERS:	J. D. Lee Engineering Ltd., Kingston.
COMPLETED:	January 13, 1967.
FINAL PROJECT COST:	\$212,225.15.

The contractor commenced work on May 18, 1966, and completed the project on January 13, 1967. The system has been in operation since that date. Final reinstatement of roads and landscaping was performed in May and June 1967.

Petrolia (64-S-178)

DESCRIPTION OF PROJECT:	Sewers, pumping station, force main and lagoon.
-------------------------	---

CONSULTING ENGINEERS:

COMPLETED:

ESTIMATED PROJECT COST:

M.M. Dillon Ltd., London.

January 9, 1967.

\$501,000.00.

Pickering (SP-66-15 & 67-S-221)

DESCRIPTION OF PROJECTS:	SP-66-15 - Duffins Creek Pollution Control System No. 1, trunk sewer, pumping station, treatment plant and outfall to Duffins Creek. 67-S-221 - Pumping station, force main and sewage collector system.
CONSULTING ENGINEERS:	Gore & Storrie Ltd., Toronto.
ESTIMATED COST FOR BOTH PROJECTS:	\$1,205,000.00

Tenders for the work covered by the municipal project were received on June 29, 1967. The lowest of the three tenders submitted was approximately 74% over the consulting engineer's estimate and it was decided to re-advertise the work together with the provincially-owned works at a later date.

The work on both projects was advertised on December 7, 1967, and tenders will be received and opened on January 9, 1968.

Port Colborne (67-S-219)

DESCRIPTION OF PROJECT:	Borden Area sewerage system.
CONSULTING ENGINEERS:	Canadian British Engineering Consultants, Toronto and Port Colborne.
EXPECTED COMPLETION DATE:	July 1968.
ESTIMATED PROJECT COST:	\$600,427.00.

Work started on this project on July 23, 1967, and is scheduled to be completed on July 23, 1968.

The contractor has maintained his construction schedule and at the end of the year had constructed approximately 60% of the main sewers and 40% of the service connections.

Port Perry (66-W-162)

DESCRIPTION OF PROJECT: New well pump, pumphouse and watermain.
CONSULTING ENGINEERS: Totten, Sims & Associates Ltd., Whitby.
EXPECTED COMPLETION DATE: February 1968.
ESTIMATED PROJECT COST: \$82,200.00.

Work was commenced in November 1967 and by the end of the year was approximately 80% completed.

St. Lawrence River Pollution Control System No. 1 (SP-66-1)

DESCRIPTION OF PROJECT:
CONTRACT 5 -Riverfront interceptor sewer. Est. contract cost \$2,857,000.00
CONTRACT 6 -Water pollution control plant. Est. contract cost - \$1,390,000.00.
CONTRACT 7 -Sewage pumping station. Est. contract cost - \$682,000.00.
CONTRACT 8 -Outfall to St. Lawrence River. Final contract cost - \$219,840.00.

CONSULTING ENGINEERS:
Gore & Storrie Ltd., Toronto.

COMPLETED:
Contract 8 – December 15, 1967.
EXPECTED COMPLETION DATE:
Contracts 5, 6 and 7 – November 1968.
ESTIMATED PROJECT COST:
\$6,309,000.00.

At the end of the year, Contract 5 was about 40% completed and Contracts 6 and 7 were about 65% completed.

Progress on Contract 5 was rather slow but had improved considerably by the end of the year and it is expected that all the work will be completed and the system placed in operation in October 1968.

Sault Ste. Marie (66-W-159) Part A.

DESCRIPTION OF PROJECT: Approximately 3900 lineal feet of 24" inside diameter watermain including valve chamber, air valve chamber and appurtenances.
CONSULTING ENGINEERS: Proctor & Redfern, Sault Ste. Marie.
COMPLETED: August 25, 1967.
FINAL PROJECT COST: \$214,722.14.

Sault Ste. Marie (66-S-200)

DESCRIPTION OF PROJECT:
CONTRACT 1 -First part of the Tarentorus Stage II trunk sewer comprising approximately 3800 lineal feet of 18" diameter force main, valve chambers, wet well and pumping station.
Est. contract cost - \$169,314.17.
CONTRACT 2 -Second part of the Tarentorus Stage II trunk sewer comprising approximately 7300 lineal feet and appurtenances.
Est. Contract cost - \$619,264.26.

CONSULTING ENGINEERS:
Proctor & Redfern, Sault Ste. Marie.

EXPECTED COMPLETION DATE:
Contract 1 – March 1968. Contract 2 – July 1968.
ESTIMATED PROJECT COST:
\$850,000.00.

Work on both contracts progressed very well. By the end of the year Contract No. 1 was 70% completed and Contract No. 2 was 60% completed.

Sault Ste. Marie (66-S-210)

DESCRIPTION OF PROJECT:

Modifications to Clark Creek sewage pumping station comprising a new vertical pump with drive shaft, steady bearings and electric motor, electric generator and electric controls.

CONSULTING ENGINEERS:

Proctor & Redfern, Sault Ste. Marie.

EXPECTED COMPLETION DATE: March 1968.

ESTIMATED PROJECT COST: \$133,000.00.

Due to delays in delivery of the new pump and other essential equipment the work on the modifications has not met the original schedule. At the end of the year about 30% of the work had been completed.

Village of Stirling (66-S-202)

DESCRIPTION OF PROJECT:

Installation of one sewage lift station and extensions to existing sewers.

CONSULTING ENGINEERS:

Hisey & Barrington, Willowdale.

COMPLETED:

June 2, 1967.

FINAL PROJECT COST:

\$89,856.63.

The contractor commenced work on January 4, 1967, and the project was completed and in operation on June 2, 1967.

Stratford (66-S-212)

DESCRIPTION OF PROJECT:

Chlorination facilities to the sewage treatment plant.

CONSULTING ENGINEERS: Canadian British Engineering Consultants, Toronto.

EXPECTED COMPLETION DATE: September 3, 1968.

ESTIMATED PROJECT COST: \$161,762.00.

The contract was executed on November 6, 1967, but work had not yet commenced by the end of the year.

Wallaceburg (65-S-181 & 67-S-226)

DESCRIPTION OF PROJECT:

CONTRACT 1 -Trunk sanitary sewer (Gillard St.). Final contract cost - \$128,750.00.

CONTRACT 2 -Trunk sanitary sewer (Gillard & Wallace Sts.). Final contract cost - \$532,514.00.

CONTRACT 2A -Interceptor sewer (Wallace St.). Est. contract cost - \$59,270.00.

CONTRACT 3 -Sanitary sewers and force main. Est. contract cost - \$800,000.00.

CONTRACT 4 -Napier-Dundas pumping station. Est. contract cost - \$66,000.00.

CONTRACTS 5, 6, 7, 8, 9, 10 and 12. -Sanitary sewers, river crossings and pumping stations.

Est. contract cost - \$1,243,319.00.

CONTRACT 11 -Sewage treatment plant. Est. contract cost - \$1,400,000.00.

CONSULTING ENGINEERS:

Todgham & Case Ltd., Chatham. Gore & Storrie Ltd. Toronto.

COMPLETED:

Contract 1 - June 28, 1966. Contract 2 - June 20, 1967.

ESTIMATED PROJECT COST:

\$4,820,000.00.

Contract 2A - Commencement anticipated early 1968.

Contract 4 - " " spring 1968.

Contracts 3-11- " " mid 1968.

Contracts 5-10 and 12 - Plans and specifications are being prepared by the consulting engineers.

Waterloo (66-S-203)

DESCRIPTION OF PROJECT: Extensions to the sewage treatment plant.
CONSULTING ENGINEERS: Proctor & Redfern, Toronto.
EXPECTED COMPLETION DATE: September 27, 1968.
ESTIMATED PROJECT COST: \$1,286,802.00

Work commenced on June 26, 1967, and was 22% completed by the end of the year. The concrete structures for the primary and secondary digesters and the new clarifier were 95% completed.

Twp. of Wicksteed (Hornepayne) (64-W-139)

DESCRIPTION OF PROJECT:
CONTRACT 1 — Water distribution system. Est. contract cost — \$241,600.00.
CONTRACT 2 — Standpipe. Est. contract cost — \$18,190.00.
CONSULTING ENGINEERS:
Kilborn Engineering Ltd., Toronto.
COMPLETED:
Contract 1 — September 22, 1967. Contract 2 — April 1967.
ESTIMATED PROJECT COST:
\$300,356.11.

The water distribution mains and services are in operation but the standpipe will not be in use until the new pumps are installed some time in the spring of 1968.

Winchester (64-W-137)

DESCRIPTION OF PROJECT: Well, pumphouse and watermain.
CONSULTING ENGINEERS: J.L. Richards & Assoc. Ltd., Ottawa.
COMPLETED: October 3, 1967.
ESTIMATED PROJECT COST: \$29,500.00.

Woodbridge (64-S-177 & SP-66-13)

DESCRIPTION OF PROJECT: Sanitary sewer system.
CONSULTING ENGINEERS: Proctor & Redfern, Toronto.
EXPECTED COMPLETION DATE: June 10, 1968.
ESTIMATED PROJECT COST: \$1,128,926.00.

Although the order to start work was issued in May, the contractor was not able to start construction until mid-July as a result of labour difficulties in the Metro area.

At the end of the year all main sewers had been completed with the exception of two river crossings. Service connections had been installed in about 40% of the Village. The contractor has maintained his construction schedule.



DIVISION OF FINANCE

E.F. HEATH Director and Comptroller

In 1967, the Division of Finance continued to seek improvements in reporting methods, processing of suppliers accounts for payment, budgeting of expenditures and accountability to municipalities for funds held in trust. During the year, monthly billings were commenced for the Lake Huron and the Lake Erie Water Supply Systems on the basis of monthly meter readings obtained from the Division of Plant Operations.

ACCOUNTING

The following statistics reflect a portion of the activities of the accounting area for a period of three years.

(A) ORDINARY VOTE EXPENDITURES (B) GROSS CAPITAL EXPENDITURES

1965/66	\$4,141,335	1965/66	\$15,065,352
1966/67	\$6,203,294	1966/67	\$25,029,984
1967/68	\$7,725,000 (EST.)	1967/68	\$17,925,000 (EST.)

(C) GROSS CAPITAL RECEIPTS

	WINTER WORKS SUBSIDIES	PAYMENTS FROM MUNICIPALITIES C.M.H.C. AND OTHERS	TOTAL
1965/66	\$336,079	\$6,577,339	\$6,913,418
1966/67	\$654,909	\$3,683,019	\$4,337,928
1967/68	\$476,361 (EST.)	\$4,600,828 (EST.)	\$5,077,189 (EST.)

EXPENDITURES IN THE OPERATION OF WATER AND SEWAGE TREATMENT PLANTS

1965	\$2,706,344
1966	\$3,006,232
1967	\$3,617,833

RECEIPTS FROM BILLINGS TO MUNICIPALITIES

	DEBT RETIREMENT	RESERVE FOR CONTINGENCIES	INTEREST	PROJECT OPERATION	TOTAL
1965	\$1,605,775	\$644,651	\$3,914,297	\$2,858,197	\$9,022,920
1966	\$1,701,159	\$637,203	\$4,074,182	\$2,966,788	\$9,379,332
1967	\$1,786,096	\$646,799	\$4,295,839	\$3,499,553	\$10,228,287

The funds received for debt retirement and reserve for contingency charges were invested by the OWRC Investment Committee in accordance with the requirements of the OWRC Act. The interest money received from billings was used by the Commission to repay, in part, the liability of the OWRC for interest on funds borrowed from the Province, while the amount received for operations was used to pay the operating costs of the projects concerned.

At December 31, 1967, loans from the Province of Ontario for the purpose of constructing water and sewage projects totalled \$114,601,287.68 (\$84,319,783.00 for municipal projects and \$30,281,504.68 for provincial projects). The effective rate of interest payable to the Province on the total amount is 5.765 per cent or some \$6,606,204.20 per annum.

BUDGET

Initial steps were taken to produce the Commission's estimates for 1968/69 on a "Program" budgeting basis. A preliminary blueprint of the Commission's activities was established within the framework of three approved programs.

In time, it is anticipated that each program will be refined in definition and in cost, in order to further develop a management information system that will assist in measuring costs in relation to accomplishments.

The classifications of expenditures were expanded and revised for purposes of maintaining costs by activities and to assist in preparation of future estimates on a program basis.

INSURANCE

A review of the insurance carried was maintained during the year 1967 and the Lake Huron and Lake Erie Water Supply Systems were added to the Commission's All Risk Insurance Policy. These additions, together with the Municipal Plants that were completed, brought the total amount of insurance carried by the Commission to \$62,986,100.00.

INTERNAL AUDIT

The audit program carried out during the calendar year ending December 31, 1967, covered many aspects of the financial transactions of the Commission with particular emphasis on the revenue and expenditures of both municipal and provincial projects. During the year, a continuous review of internal controls was performed in order to ensure that the accounting records were prepared in accordance with prescribed policies.

Assistance was provided with respect to financial procedures as they relate to the electronic data processing functions, print shop operations, and other areas within the Commission, where required. Continuous assistance was provided to municipalities upon request in the installation of accounting and billing systems and in the instruction of municipal staff in the maintaining of records.

ONTARIO WATER RESOURCES COMMISSION (Constituted by Special Act of the Ontario Legislature)

BALANCE SHEET as at December 31, 1967.

ASSETS

CAPITAL ACCOUNT

Cash in Bank	\$ 980,655.37
Recoverable Advances	71,750.22
Accounts Receivable	3,008,104.94
Capital Assets	
Completed Projects owned by Ontario Water Resources Commission	86,868,243.63
Capital Advances for completed Municipal Projects	25,594,743.79
Construction in progress	8,536,609.80
Amounts due from reserve account	12,827.74
	<u>\$125,072,935.49</u>

RESERVE ACCOUNT

Cash in Bank	\$ 196,410.20
Accrued interest receivable	54,327.86
Investments (market value \$3,122,837.50)	3,533,077.12
	<u>\$ 3,783,815.18</u>

DEBT RETIREMENT ACCOUNT

Cash in Bank	\$ 508,021.57
Accrued interest receivable	172,920.85
Investments (market value \$9,321,728.75)	10,533,285.12
Amounts due from capital account	25,445.87
	<u>\$ 11,239,673.41</u>
	<u>\$140,096,424.08</u>

NOTE: As at December 31, 1967, commitments had been made under final agreements executed for the construction of projects requiring additional gross expenditures of approximately \$14,000,000.00.

LIABILITIES

CAPITAL ACCOUNT

Accounts payable and contract retentions	\$ 4,628,218.64
Advances from municipalities and others	
Operating and interest	\$1,192,536.34
Capital	4,525,446.96
Due to Province of Ontario	
Treasury Department advance	100,000.00
Funded debt payable to Province of Ontario	\$114,601,287.68
Amounts due to debt retirement account	25,445.87
	<u>\$125,072,935.49</u>

RESERVE ACCOUNT

Funds for renewals, replacements and contingencies under Section 43 of the Act	\$ 3,770,987.44
Amounts due to capital account	12,827.74
	<u>\$ 3,783,815.18</u>

DEBT RETIREMENT ACCOUNT

Sinking fund for the recovery of the cost of capital assets at 3 1/4% under Section 44 of the Act	\$ 11,239,673.41
	<u>\$ 11,239,673.41</u>
	<u>\$140,096,424.08</u>

DIVISION OF INDUSTRIAL WASTES

D.P. CAPLICE Director H.A. CLARKE Assistant Director

The Division of Industrial Wastes is responsible for the administration and regulatory function of the Commission in industrial waste control as set out in Sections 27, 31 and 50 of the OWRC Act. The Division is organized into three functional branches.

The Administration Branch directs and co-ordinates all the activities of the Division and provides the stenographic, typing, clerical and statistical services for the engineering branches.

The Field Services Branch (1) maintains a quality and quantity inventory of industrial waste disposal in Ontario; (2) investigates, on a regular basis, all industrial sources of water pollution and prepares engineering reports which form the basis for obtaining compliance with the terms of the OWRC Act for pollution control; and (3) assists municipalities and industries in waste control by providing a technical advisory service related to appraisal of new-industry locations or expansion of existing plants.

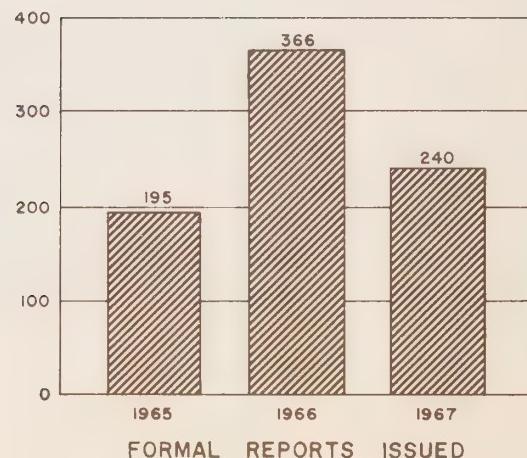
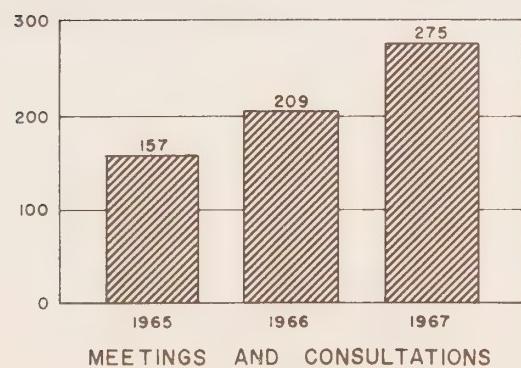
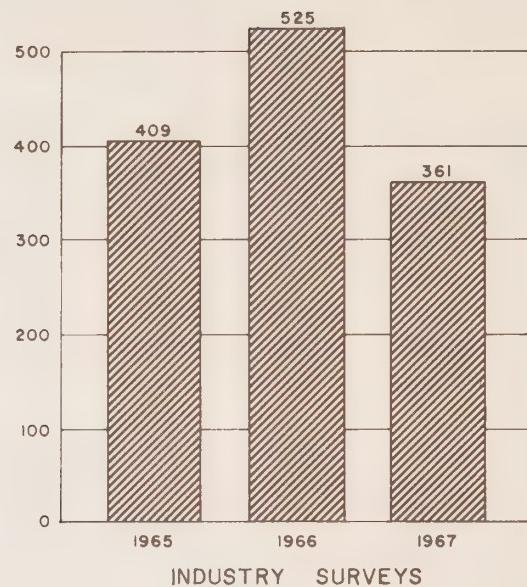
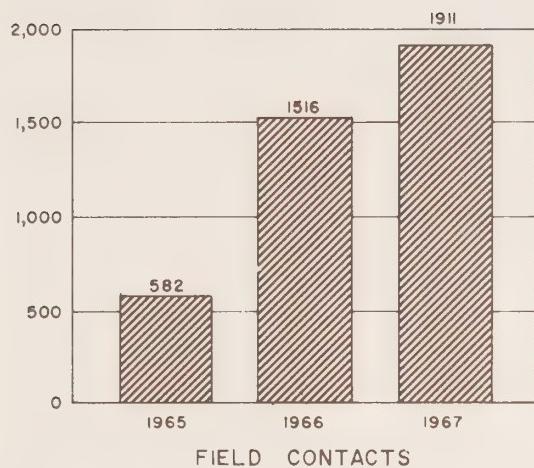
The Design Approvals and Special Projects Branch carries out the following functions: (1) the review of engineering plans for the collection, treatment, transmission and disposal of wastes from new or expanding industrial operations and the preparation of certificates of approval as required by Section 31 of the OWRC Act, (2) provides specialized technical appraisal of difficult waste treatment problems, and (3) carries out detailed industrial studies leading to the preparation of reports for certain types of industry on a province-wide basis.

Field Services Branch

Emphasis was placed by field staff on wide coverage of industrial installations in 1967. An attempt was made to visit every industry at least once during the year to review waste treatment and disposal practices. An increasing number of industries continued to install waste treatment works; however, experience has shown that regular visits are required by field personnel to ensure that these works are operated effectively. Over a period of several years, many formal reports on industrial waste surveys have defined the existing pollution problems, especially at older plants. Thus, with this well-established base of information, an intensive effort is being made to have these industries install corrective measures through a series of meetings and discussions with their representatives.

In 1967, this Branch assumed an additional workload by becoming responsible for waste control at canneries — a large segment of the diversified food processing industry. Also, much time was spent in collecting industrial waste data for the Great Lakes Survey. Waste treatment works for twenty-nine new industries built in 1967 were reviewed with company representatives and appraised in collaboration with the Design Approvals Branch. A summary of activity in the major industrial classifications and the status of pollution control is given below.

DIVISION OF INDUSTRIAL WASTES
FIELD SERVICES BRANCH



STATUS OF CONTROL IN THE MAJOR INDUSTRIES

(a) Pulp and Paper

Some progress was made during the year towards achieving the objectives for waste control that were placed before the pulp and paper industry in 1965. In general, the industry continued to implement implant measures to minimize product losses to sewers. Twelve applications for approval of engineering plans were received during 1967 at an estimated cost of \$770,000.00. Present work by the industry is aimed primarily at reducing the amounts of suspended solids being discharged to watercourses, but a few mills are examining the possibilities of installing chemical recovery processes, such as the incineration of sulphite waste liquors, to overcome pollution problems due to excessive organic waste discharges.

Of the forty-two mills in Ontario, two did not operate during 1967 and six installations are considered to have satisfactory waste treatment through access to municipal sewage treatment works. A further two installations were to have been connected into municipal sewage systems during 1967 but these connections are now scheduled for early 1968. Four more installations are considered to have satisfactory removal of suspended solids in their discharges to watercourses. The remaining twenty-eight installations are considered to have unsatisfactory or incomplete control of suspended solids at this time although control programs, scheduled over the next few years, have been received in some instances.

Work is being carried out by the industry on the problem of removing bark fines remaining in the woodroom effluents after coarse screening. No satisfactory solution to this problem is available to date, but one or two systems are encouraging and could be operative in 1968.

Commission staff carried out field studies as part of a program of continuing surveillance. These studies indicate that there has been some progress in the removal of suspended solids from discharges to watercourses but little progress in pollution control has occurred in the areas of BOD (Bio-

chemical Oxygen Demand) removal, taste and odour, toxicity and aesthetic considerations, all of which require a form of secondary treatment.

Two stream assimilation studies were conducted on rivers below the outfalls of a large kraft mill and a newsprint mill. These studies are considered to be very necessary to the overall pollution control program in that they will indicate the effects of continued mill discharges on the watercourses and also indicate what limits must be placed on these discharges in order to prevent harm to rivers.

(b) Steel

Construction of projects initiated in 1966 was the prime pollution control activity at the steel mills this past year.

Dominion Foundries and Steel, Limited, completed several such projects including a biological treatment plant for phenol removal, an ammonium sulphate recovery plant, and a hydrogen sulphide and cyanide removal plant. A facility for the removal of suspended solids from oxygen steel furnace flue dust slurry was completed and is approaching its design efficiency. These measures are to be supplemented by a polishing lagoon which is nearing completion, and it is expected that this will effectively control the wastes from the basic iron and steel making facilities. An oil reclamation system was installed to serve part of the cold rolling operations. The control of oil losses and disposal of pickle liquor are the main projects now under consideration by the Company.

The Steel Company of Canada, Limited, is expanding its production with the addition of a new blast furnace and coke ovens. The waste control measures for these new operations have been approved by the Commission. The Company also completed a new clean water sewer which will reduce the hydraulic loading on treatment facilities. Improved control of oil losses is being investigated. The conversion of a second pickle line from sulphuric to hydrochloric acid will be completed in 1968 and will largely eliminate the spent acid disposal problem at the main plant.

The construction of a phenol recovery plant at The Algoma Steel Corporation, Limited, was essentially completed. When this plant goes into operation, the majority of the phenol losses will be eliminated. This Company also completed a large sewer to segregate uncontaminated cooling water from process wastes, thereby lessening the hydraulic load on some of the treatment facilities. The reduction of oil losses is a subject of continuing investigation on the part of the Company and work continues on the destruction of cyanide from the coking operations.

The most serious remaining problem of common concern to the industry is the control of oil pollution. As the problem can best be attacked at the source, the Commission is encouraging studies of in-plant measures to reduce or eliminate oil losses.

(c) Chemical and Petroleum

The chemical and petroleum industries continued the development of waste control programs to meet the Commission's objectives for industrial waste discharges. Applications for Commission approval of waste treatment and disposal works were received in 1967 from many of these industries and included the following: Polymer Corporation Limited; Imperial Oil Enterprises, Limited; Canadian Industries, Limited; Dow Chemical of Canada, Limited; Union Carbide Canada, Limited; Shell Canada, Limited; Electric Reduction Company of Canada, Limited; and Regent Refining (Canada) Limited. These applications represent a total expenditure by the industry of approximately \$2,000,000.

As in previous years, all major chemical and petroleum plants in the Province were resurveyed to determine the adequacy of waste disposal methods. Since most of these industries are large water users, and located on the Great Lakes System, their effluents were sampled on a composite basis at least three times during the year in conjunction with the Great Lakes Survey program being carried out by the Water Quality Surveys Branch of the Division of Sanitary Engineering.



Waste equilization facilities prior to biological treatment at an oil refinery.

(d) Mining

During 1967, field staff were active in all mining areas in Ontario, with the majority of producing properties being visited on at least one occasion. A program of inspection of dormant and defunct tailings disposal areas was instituted to determine the pollution potential and the need for rehabilitation of such areas. The detrimental effects of wind, rain and other weather conditions can result in failures of retaining dams, with consequent pollution of lakes, rivers and streams. Much attention was given, therefore, to the factors governing the establishment of vegetation on tailings piles, since a strong vegetative cover appears to offer the most desirable means of permanently stabilizing the piles.

Extensive studies were carried out in the Sudbury, Timmins and Cobalt areas where the nature, extent and effects

of water pollution by mining wastes and the defects and limitations of present tailings disposal practices were clearly defined.

As a result of increased surveillance of mining operations and a general letter to the industry outlining the requirements of Section 31 of the OWRC Act, proposals for new or improved waste control systems were received from companies in Bruce Lake, Elliot Lake, Sudbury, Timmins and Cobalt. Improvements of tailings areas were effected at fourteen operating properties.

The number of operating mines decreased slightly during the year, but closures had no significant effect at any of the mining districts except Kirkland Lake, which now has only one producing mine. Pollution preventative measures were adopted in the area north-east of Peterborough where two companies, the sole producers of nepheline syenite in North America, carry on operations.

To offset the closures, exploration and development is under-way in all areas, and the increase in the price of silver and renewed interest in uranium has stimulated activity in the Cobalt-Gowganda, Bancroft and Elliot Lake areas.

(e) Food Processing

The trend towards consolidation of small plants into larger operating units continued in the milk processing industry. This is illustrated by the reduction in the number of milk processing plants from 278 in 1965 to 224 in 1967. The majority of these plants employ some form of private waste treatment or dispose of their wastes to municipal sewer systems. Of those with private disposal systems, acceptable treatment is obtained in most cases between the months of May to November and during the year greater efforts were made to implement satisfactory year-round treatment and disposal. About 15 per cent of those plants with such problems were able to effect satisfactory solutions in 1967.

In the meat processing industry, most of the large operations are utilizing municipal sewage treatment facilities. Good progress in pollution control was achieved at a number of small rural slaughterhouse operations which installed total retention systems to eliminate their waste disposal problems.

After completing a number of in-plant measures to reduce waste loadings, one of the major companies in the brewing and distilling field was able to direct the remaining plant wastes to a municipal sewage treatment plant. This appears to be the most economical method of disposal for this type of industry provided the capacity exists at the treatment plant. Two other firms are considering private treatment because of their particular locations. On the whole, the industry now contributes a relatively small waste loading to the surface waters of the Province.

Considerable headway was made in the reduction of pollution by the specialty food and cereal products group of industries. About 40 per cent of the outstanding problems were corrected by diverting the wastes to municipal systems and by the elimination of wet processes.

There are approximately 106 canning and vegetable packers in Ontario. The majority of these plants employed some form of waste treatment, usually comprised of the removal of coarse solids followed by lagooning. A number of those plants which did not have acceptable waste control programs were able to implement corrective measures in 1967. Action continues to resolve the outstanding problems.

(f) Secondary Manufacturing Industries

Included in this category are metal working and metal finishing plants, tanneries, textile mills and service establishments.

In the metal working and metal finishing industries, measures to remove oils, suspended solids and toxic components, and to reduce the acidity or alkalinity of the wastes are often

required to render the wastes acceptable for discharge to municipal sewers or a natural watercourse. Major undertakings to meet these requirements have been brought into operation during 1967 by East Side Plating, Limited; Hudson Bay Die-casting, Limited; Plasticast, Limited; P.L. Robertson Manufacturing Company, Limited; Ontario Steel Products Company, Limited; R.C.A. Victor Company, Limited; Douglas Aircraft Company, Limited; and Anaconda American Brass, Limited.

In the tanning and textile industries, the disposal of wastes to municipal sanitary sewerage systems is often the only practicable approach to pollution control. This is practiced by most of the plants in these industries with few adverse effects.

Service industries are not usually regarded as significant sources of contaminated wastewater. However, rail and tank truck transport companies have presented problems due to wastes from refueling and interior and exterior tank truck cleaning operations. Oil is the most significant contaminant from these sources and a stepped-up program of pollution abatement is being requested from the offending industries particularly in the case of the railways.

LEGAL ENFORCEMENT MEASURES

Although industry has a good record of cooperation with the OWRC, in the final analysis it would appear that the threat of punitive action is the necessary spur to precipitate satisfactory action in a small number of cases. Therefore, greater emphasis was placed in 1967 on using existing legislation in those instances where it became apparent that progress in industrial waste control had come to a stalemate after lengthy discussions and field work. As a result, eight charges were laid under Section 27 of the OWRC Act for potential impairment of receiving watercourses. Six of these were successful, one is being appealed and the last is due for hearing in early 1968. In general, legal action appeared to produce the desired effect in that corrective measures were implemented

by the industries involved. In addition, one Requirement and Direction under Section 50 of the OWRC Act was served on a fertilizer producing company which resulted in satisfactory waste treatment facilities being installed.

With such encouraging success, these and other sections of the Act applicable to the disposal of wastes will continue to be used where deemed justifiable and necessary.

Design Approvals and Special Projects Branch

(a) DESIGN APPROVALS

Control of industrial waste disposal is regulated through the implementation of Section 31 of the OWRC Act, which requires industry to submit applications to the Commission for approval of plans for the collection, transmission, treatment and disposal of industrial wastes. Applications are reviewed and, if found satisfactory, certificates of approval are issued.

Table I summarizes the processing of applications in 1967, while Table II is a breakdown of the 65 certificates issued in 1967, listed by general types of industry.

The most comprehensive proposal for industrial waste treatment facilities, estimated to cost \$2,850,000, was submitted by Chrysler Canada Limited, to serve its automobile assembly and engine manufacturing plants in Windsor. The facilities, designed mainly for oil removal, are scheduled to be in operation in late 1968, and should provide an effluent quality to the Grand Marais Drain within OWRC objectives.

The processing of an application from R.C.A. Victor Company, Limited, for treatment facilities, costing an estimated \$380,000, to serve its new coloured television tube plant in Midland, involved, in addition to the R.C.A. Victor Company, two consulting engineering groups, a supplier of filter equipment and the municipality. The proposal progress-

ed smoothly to certification through excellent cooperation by all parties and their attendance at a number of meetings held in the Division offices. The Design Approvals Branch later made an inspection and evaluation of the system, consisting of integrated neutralization and solids removal facilities, under operating conditions. The treatment provided was found to be satisfactory.

One public hearing, in accordance with Section 32 of the Act, was held in Leamington, on the application of Hillside Canning Limited, for the installation of treatment facilities consisting of lagooning and spray irrigation, to serve the Company's new tomato canning factory in the Township of Mersea. The Company's plans were approved on condition that it submit a report on the method of operation of the treatment facilities.

In 1967, considerably more emphasis was placed on installation of monitoring systems and programs, and companies were requested to undertake, on completion of the treatment facilities, adequate surveillance of the effluent quality and operation of the facilities.

TABLE I

Summary of Projects for 1967

APPLICATIONS OUTSTANDING AS OF DEC. 31, 1966	22	
APPLICATIONS RECEIVED 1967	104	TOTAL 126
CERTIFICATES OF APPROVAL ISSUED	65	
APPLICATIONS REVIEWED-CONCURRENCE GIVEN	18	
APPLICATIONS REVIEWED-APPROVAL NOT GIVEN	16	
APPLICATIONS UNDER REVIEW AS OF DEC. 31, 1967	19	
APPLICATIONS HELD IN ABEYANCE AS OF DEC. 31, 1967	8	TOTAL 126
PROJECT MEETINGS	106	
TOTAL ESTIMATED CAPITAL EXPENDITURES		
CERTIFICATES OF APPROVAL (65)	\$10 827.580	
CONCURRENCES (18)	286,250	
	TOTAL	\$11,113,830
APPLICATIONS UNDER REVIEW OR IN ABEYANCE AS OF DEC. 31, 1967 (27)		\$ 979,600

TABLE II

1967 Certificates Issued - Industry Classification

	NO. OF CERTIFICATES	CAPITAL COST
CHEMICAL	9	\$ 1,112,400
FOOD	16	219,100
MANUFACTURING	21	4,372,880
MINING	7	2,063,700
PETROLEUM	3	813,000
PULP AND PAPER	5	777,500
STEEL	4	1,469,000
	65	\$10,827.580

(b) SPECIAL PROJECTS

Provincial Sewage Works

The evaluation of potential industrial waste loadings in the design reports prepared for provincially-financed sewage works programs is a continuing function of the Special Projects Group. During 1967, 47 design reports were reviewed and numerous meetings were attended by staff.

Municipal Sewer-Use By-Laws

Because of increasing problems and requests for advice associated with the discharge of industrial wastes to municipal sewers, a draft sewer-use by-law was prepared with the cooperation of the legal staff to serve as a guide to municipalities considering revision or enactment of such a by-law. To further assist persons involved in municipal industrial waste control, a comprehensive brochure was prepared setting out guidelines for the proper discharge of industrial wastewater to municipal sewers. Final printing of this brochure is expected early in 1968.

Uranium Mining, Milling and Refining Industry

A continuing program of surveillance was carried out on the waste disposal practices in the uranium mining, milling and refining industries. All of the operating mines in Ontario have instituted satisfactory control measures and have planned for the long term disposal of their mill tailings. Considerable attention was devoted to the dewatering operations at a mine in the Bancroft area and to the incorporation of satisfactory control measures at a proposed new mine in the Agnew Lake area.

Chemical Waste Treatability Studies

In cooperation with the divisions of Research and Laboratories, an intensive investigation was conducted into the waste disposal practices at a chemical plant in Elmira which manufactures herbicides and other organics. The purpose of this investigation was to determine the sources and characteristics of the various waste streams. The effects of these wastes on the operation of the municipal sewage treatment plant, and the subsequent effects of the treated effluent on the receiving stream, continue to be studied.

Thermal Generating Stations

Several discussions were held with Ontario Hydro officials and representatives of the Department of Lands and Forests concerning thermal pollution in the Great Lakes system from thermal generating stations. Extensive water quality and



*Sampling
of waste
discharges
from a
thermal
generating
station.*

biological studies began in the Nanticoke and Pickering areas of Lake Erie and Lake Ontario, respectively, to establish sound baseline data prior to start-up of these plants. Industrial waste surveys were also conducted at the Richard Hearn and Lakeview stations in the Toronto area.

Committees

Staff of the Division served on a number of committees during the year. The Director chaired a sub-committee on industrial wastes which reported to the Deputy Minister's Advisory Committee on Pollution Control, and was an ex-officio member of a liaison committee which was established by the OWRC. Sixteen government departments and commissions are represented on this latter committee. Both committees permit good communication to be established with other governmental advisors on matters of industrial waste pollution. Matters dealing with control of radioactive pollution from nuclear generating stations were discussed by the Reactor Safety Advisory Committee relative to installations at Rolphton (Nuclear Power Demonstration), Douglas Point and Pickering. Several meetings were attended of the Sub-Committee on Radioactivity also established by the Deputy Minister's Advisory Committee. These meetings dealt with monitoring of watersheds in the Elliot Lake and Bancroft regions. Also, there was active participation in the Water Quality Objectives Committee which formulated the recently revised policy guidelines for water resources management in Ontario. At year end, work was continuing on developing the basic water quality objectives. Finally, studies continued on the Division's requirements for electronic data processing, and action was initiated on a series of coding systems.

DIVISION OF LABORATORIES

J.H. NEIL Director

The year 1967 was one of major expansion in the analysis and field work associated with the Division of Laboratories. A number of new analytical instruments were introduced and a significant portion of the results was processed in a form suitable for electronic data processing.

The greatest increase in analyses in the history of the laboratory took place this year as 37% more samples were received, resulting in a 52% increase in tests performed. While the cost of materials and labour rose during the year, an over-all reduction in cost of 21% per determination was achieved. New instrumentation, overtime, work organization and an enthusiastic staff all played a part in attaining this new level of productivity.

Field activities, largely associated with the Biology Branch, were expanded to cover intensive biological surveys of rivers affected by pollution, from the far western part of the Province to the Quebec border. A number of special studies were participated in by branches of the laboratory. Of particular importance was the role played by staff of all branches in the Great Lakes study. Special laboratories, established to handle Great Lakes' samples in London and Toronto, experienced a major increase in the level of work, and this investigation alone accounted for 21% of all samples received. Biological studies included shipboard sample collection of bottom fauna and plankton. The report on the findings of this work, undertaken on behalf of the International Joint Commission, is in an advanced stage of preparation. The Bacteriology Branch carried out the routine coliform analyses required for Great Lakes work and investigated the role of natural bacterial flora in lake waters and bottom sediments.



TECHNICIAN DOING BACTERIOLOGICAL ANALYSIS

This technician is performing an analysis for coliform bacteria, using the membrane filter technique. The coliform bacteria are filtered from the water, grown on selective media for 24 hours, then counted. This test is used to trace bacterial pollution in studies of lakes and rivers. The absence of these bacteria ensures the purity of municipal water supplies.

Division staff, assigned to the radiological study in the Elliot Lake area, carried out a continuing biological survey program, with chemical analyses, providing water quality data, being carried out in the main laboratory.

The interesting nature of the work of the laboratory attracts many groups to the building for courses, lectures and tours. Related university courses, professional associations, school groups and interested agencies were all accommodated during the year. This service has drawn heavily upon the resources

of technical staff, and a more formalized method of dealing with this educative function will be required in the future.

Renovations and expansion of laboratory facilities were a major aspect of the year's activities. Plans were completed for the first major renovation of space and equipment after eight years of occupancy of the laboratory. At the year's end, the Department of Public Works was actively engaged in carrying out this work. An associate architect was appointed by the Department to plan an addition to the existing laboratory building which would provide additional space to accommodate the demand for increasing laboratory services. The London regional laboratory, established during the year to carry out Great Lakes analyses, commenced handling samples from District I, as well.

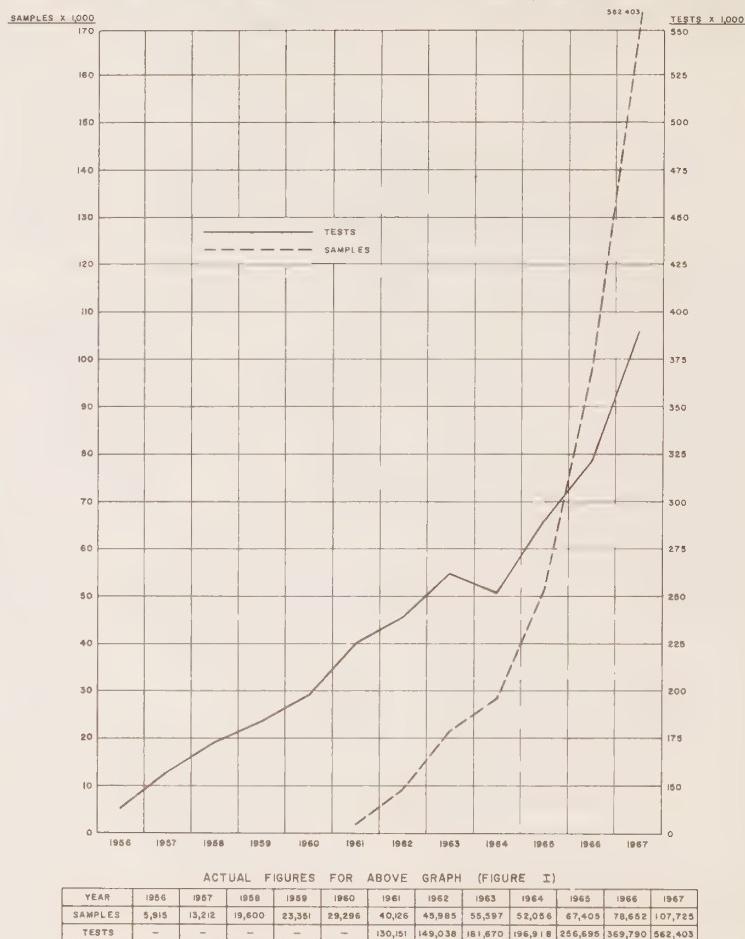
Table I provides information on the number of samples received, by branches, during the year and the number of determinations carried out. Figures relating this information to 1966 are included. Figure I indicates the trend in analytical demand experienced during the existence of the Commission.

TABLE I

	NO. OF SAMPLES		% IN- CREASE		NO. OF DETERMINATIONS		% IN- CREASE	
	1966	1967			1966	1967		
BACTERIOLOGY	32,252	42,940	33.3		76,525	114,177	49.2	
BIOLOGY	3,260	7,065	116.7		2,898	6,653	129.2	
CHEMISTRY I	—	—	(276,779)	(420,315)	—	—	52.0	
CHEMISTRY II	—	—	(13,588)	(21,258)	—	—	56.0	
CHEMISTRY, TOTAL	43,140	57,720	33.8		290,367	441,573	52.0	
TOTAL	78,652	107,725	37.1		369,790	562,403	52.1	

FIGURE I

ANNUAL SAMPLES RECEIVED BY THE DIVISION OF LABORATORIES
AND THE NUMBER OF TESTS PERFORMED, 1956-1967



Bacteriology Branch

The comparative evaluation of the Membrane Filter (MF) procedure and the Presence-Absence (P-A) test for detecting coliforms in municipal drinking water supplies was extensively investigated. The P.A test was found useful for demonstrating bacterial pollution employing parameters such as fecal coliforms, fecal streptococci, *Pseudomonas aeruginosa* and *Clostridium welchii*.

The introduction in 1968 of an integrated MF and P-A water analysis program was planned with members of the Division of Sanitary Engineering. A rapid system was devised for communicating the results of unsatisfactory water samples to those involved as soon as these results were available at the laboratory. A typed report, giving complete details on the various bacterial pollution parameters, will be mailed at a later date when all confirming tests were completed.

An evaluation was made of MF media and incubation temperatures for improving methods to detect fecal streptococci. The problem of non-coliform sheen colonies on m-Endo MF broth was also studied to find out if sheen formation could occur with constituents in the medium other than lactose.

The use of fungicides to suppress filamentous organisms in sewage treatment plants was examined. Several disinfectants suggested for use in marine toilets were assayed for their effectiveness. Comparative tests were performed on membrane filters from three different manufacturers to determine their relative quality. A project designed to study bacterial response to an aquatic weed control chemical was undertaken. Weed, water and mud samples were collected and changes in their bacterial flora were recorded before, during and after chemical treatment.

Bacteriological staff of the Toronto and London laboratories participated in lectures and laboratory demonstrations of analytical procedures. Two senior technicians from the

Nova Scotia Department of Health were given a week of training on special aspects of Water Bacteriology. Tours, lectures and laboratory demonstrations were arranged for many other groups throughout the year.

A revised and updated bacteriological report form was introduced which increased the number of bacterial parameters reported and which permitted the computerized tabulation of results at a later date. In preparation for analysis of District #1 samples at London, submissions by staff of the divisions of Sanitary Engineering and Plant Operations were reviewed and schedules prepared to effect an efficient use of the London laboratory's capacity for handling samples.

With the commencement of the 1967 Great Lakes Survey, facilities for the bacteriological analyses of samples were established in the Toronto and London laboratories, and temporarily in Sault Ste. Marie and Port Arthur. All samples were analyzed for total coliforms and a limited number for heterotrophic bacteria. A new depth sampler, devised in conjunction with the Mechanical Services Branch, was introduced. This device collected water samples in sterile containers and was successfully employed for the entire survey.

Investigations into the types and distribution of heterotrophic bacteria in lake water samples were conducted. Bacterial cultures were isolated from total plate counts and identified to the generic level. Preliminary work on the bacteriology of lake sediments was begun with establishing techniques for the enumeration of aerobic and anaerobic heterotrophic bacteria.

Print-outs of coliform data from the 1966 Great Lakes Survey were received from the Data Processing Centre; these were checked, and adjustments were made to the program to permit retrieval of all suitable results. Data from the 1965 Detroit and St. Clair River Surveys were checked and transcribed to bench sheets in cooperation with the Water Quality Surveys Branch. A revision of the program for retrieval of 1967 coliform data was made.

Various solid media for the enumeration of coliform organisms from surface water supplies were compared with m-Endo Broth for effectiveness in recovery of coliform organisms. This comparison was made to investigate the use of solid media in field operations where preparation of liquid media might prove difficult. The effect of storage at different temperatures for various periods of time on the coliform and heterotrophic bacterial densities of lake water samples was investigated. The results of these experiments will provide guidelines for methods of handling bacteriological samples prior to analysis.

Drinking water samples submissions from all sources increased by 16% and totalled 20,258 in 1967. These samples represented the largest portion of this Branch's routine sample workload, indicating more investigation of drinking water quality throughout the Province. It is of interest that the Province's drinking water quality (as measured by annual samples analyzed) meets the Drinking Water Quality Objectives set by the Commission. Over 95% of the water samples were negative for coliform bacteria where the objectives require 90% freedom from these bacteria. The number of samples from raw water sources, both rivers and lakes, showed the greatest increase of all types (37%) and totalled 19,442. Of these, Great Lakes samples alone increased by 33% over 1966 figures, and totalled 10,281 with 5,202 analyses being performed in the Toronto laboratory and 5,079 in the London laboratory. Sewage samples also increased by 10% over 1966 and 3,152 were analyzed. By direct comparison with other types of samples, these seem small in number, but a sewage sample takes four times longer to examine than does a drinking water sample. Fewer nuisance organism samples were analyzed this year because of emphasis placed on other programs and the reduced technical capacity in this area. The London laboratory analyzed 1,785 regional samples, primarily from the Lake Huron and the Lake Erie pipeline supplies.

Pure-culture studies of bacteria to confirm and monitor sensitivity of methods and to understand the distribution and occurrence of microbial populations in water and wastes were increased in 1967, with 4,460 isolates identified.

A total of 42,940 samples submitted to this Branch received 114,177 determinations, with approximately one-sixth of these samples and one-tenth of the determinations handled in the London laboratory. This represents a 25% and 33% increase in samples and determinations over the 1966 workload.

TABLE II
Comparison of Sample and Determination Statistics for 1966 and 1967

	1966	1967	PERCENTAGE INCREASE
DRINKING WATER SAMPLES	17,026	20,258	16%
SURFACE WATER SAMPLES	12,201	19,442	37%
SEWAGE & WASTE SAMPLES	2,825	3,152	10%
MISCELLANEOUS SAMPLES	200	88	
TOTAL SAMPLES	32,252	42,940	25%
TOTAL DETERMINATIONS	76,525	114,177	33%
GREAT LAKES SAMPLES	6,848	10,281	33%
LONDON LABORATORY SAMPLES		6,864	

SAMPLES IN CONDITION UNSUITABLE FOR ANALYSES TOTALLED 263.

BACTERIOLOGY BRANCH
TOTAL SAMPLES FROM 1956 TO 1967

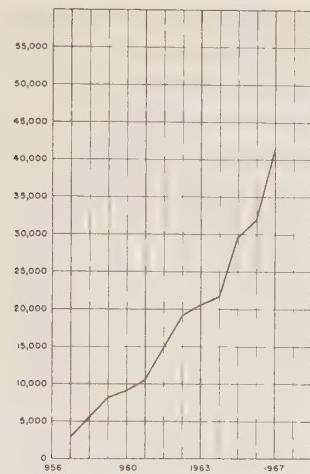


FIGURE II

BACTERIOLOGY BRANCH
TOTAL DETERMINATION FROM 1961 TO 1967

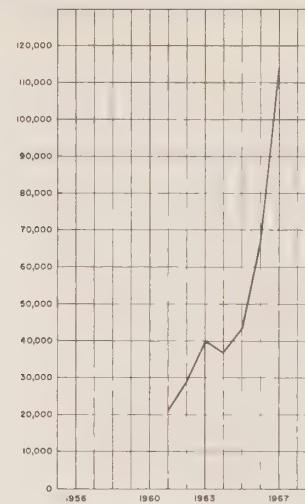


FIGURE III

Biology Branch

The biological survey program of the Biology Branch is designed to evaluate the presence or absence of pollution using biological parameters and to determine the effect of pollution on aquatic life. Major surveys carried out during 1967 included one in northwestern Ontario, three in north-central Ontario and five in southern Ontario.

The Winnipeg River was examined between Kenora and the Dalles Rapids to evaluate the impact of combined sanitary and industrial wastes originating at Kenora. Portions of the Abitibi River below Iroquois Falls and the Spanish River below Espanola were examined intensively to complement waste-

water assimilation studies carried out by the Water Quality Surveys Branch of the Division of Sanitary Engineering. In southern Ontario, watershed surveys were undertaken on the Sydenham River and on the Moira River to evaluate the effects of several inputs of sanitary and industrial wastes to these waters. The upper Thames River was examined to complete biological studies of water quality which were begun on the lower Thames River and the Avon River in 1965.

The first part of a two-year project on the Credit River was begun in 1967. This work is being carried out in co-operation with the Department of Lands and Forests, the Department of Agriculture and the Credit Valley Conservation Authority in order to provide more comprehensive information on the impact of all aspects of land and water use on the Credit River and its usefulness as a water resource. In addi-

tion to the sampling of routine biological parameters, emphasis was placed on the determination of the relative contributions of major nutrient elements contributed by various land and water use practices on the watershed.

The survey carried out on the St. Lawrence River in 1966, in which conditions below Cornwall were evaluated, was extended in 1967 to cover the section between Lake St. Lawrence and Kingston. At Sault Ste. Marie, the combined effects of industrial and municipal wastes were determined during a six-week study of the St. Marys River.

In addition to the aforementioned surveys, surveillance programs on Nipigon Bay, Bruce and Pakwash Lakes of the English River system, Lake St. John, and the lower Thames River were undertaken as part of a continuing biological monitoring program to establish trends in water quality.

Reports were completed on biological surveys carried out in 1966 on the Kaministikwia River and Thunder Bay, Otter Lake, and the Grand River.

Biological studies in connection with the Great Lakes Survey Program were intensified in 1967. Water quality was assessed by sampling of chlorophyll, plankton and benthic invertebrate species, in conjunction with physical and chemical studies carried out on major vessels operated by the Water Quality Surveys Branch. To determine the effects of wastes originating within Ontario, attention was concentrated on the near-shore portions of the lower lakes on the Canadian side. However, preliminary sampling runs were completed on Lake Huron and Lake Superior to permit comparisons with conditions in the lower lakes, and to provide background information for future water quality studies.

As a continuation of a program commenced early in 1966, phytoplankton analyses were continued on samples received weekly from 15 water works along the lower Great Lakes system, between Sarnia and Cornwall. Analyses to determine the presence of DDT residues in fish were completed on fish samples obtained from Lake Erie and Lake Ontario. Tax-

onomic work and the compilation of data for Lake Erie and Lake Ontario were finalized during the latter part of the year, and considerable progress was made in developing a contribution to the 1968 report of the International Joint Commission on the status of pollution in the lower lakes.

Work proceeded during the second year of a three-year program to assess the effects of radioactive and chemical pollution on the Serpent and Crowe River watersheds, in the Elliot Lake and Bancroft uranium mining areas, respectively. Bottom fauna were collected to monitor the impact of uranium milling wastes on aquatic populations and to determine radioactivity levels in fish and other forms of aquatic life. Chlorophyll samples were obtained from Quirke Lake, which was seemingly affected by changes in water chemistry, and from Dunlop Lake, which was used as a control situation. The chlorophyll determinations were made to complement earlier studies of primary production in the two lakes, based on C¹⁴ productivity assessments. Extensive netting of fish was carried out during the fall, through the co-operation of the Department of Lands and Forests, in an attempt to collect lake trout eggs from Quirke Lake and Dunlop Lake for comparative hatchability studies. Numerous radiological analyses were completed by the Radiation Protection Laboratory of the Department of Health on plankton, invertebrates and fish collected throughout the Serpent River watershed. A portion of an interim report outlining the results of the 1966 program was prepared. This report combined a contribution from this Branch with those of the Water Quality Surveys Branch, of the Division of Sanitary Engineering, the Division of Industrial Wastes and the Division of Water Resources.

Samples were submitted from the following communities for phytoplankton enumerations: Lindsay, Elliot Lake, Kingston, Cobalt, Timmins, Hanover, Sault Ste. Marie, Brantford, Ear Falls, Chapleau, Warkworth, Midland, Temagami, Pembroke, Hastings, Sudbury, Belle River, and the townships of Dysart, Gould, and Willoughby. In addition, routine sampling programs

for phytoplankton enumerations were carried out for Big Otter Creek, Big Rideau Lake, Quirke Lake, Lake Wahnapitae, the Wahnapitae River and the Boyne River. Threshold odour evaluations were adopted as a routine adjunct to phytoplankton identification and enumeration work, in order to develop a better understanding of the relationships between phytoplankton populations and the development of adverse tastes and odours in water supplies.

Reports evaluating the suitability of water for municipal use were compiled for Hastings, Welland, Timmins, Rockland, Chapleau, Dysart, Blind River and that portion of Lake Ontario fronting on Ontario County.

Fourteen water works operators, representing twelve municipalities, completed routine algae enumerations during the year, as a contribution to the Branch's provincial phytoplankton inventory program. A total of 827 counts were submitted to the OWRC by enumerators at Goderich, Union, Cedar Springs, Dunnville, Hamilton, Lindsay, Peterborough, Smith Falls, Cornwall, Kingston, Sudbury, and the Township of Bertie. In addition, water supplies were monitored during problem periods at the municipalities of Belleville, Cobourg, Ottawa, Toronto, Mississauga and Windsor. Also, in connection with this program, an Algae Identification and Enumeration Course was held early in April, and spring and fall editions of the 'Algae Counter's Review' were prepared and distributed to co-operating municipalities. Test samples to evaluate technical accuracy were forwarded to the water works operators involved.

An inter-divisional program for evaluating and remedying taste-and-odour and filter-clogging problems was initiated. To date, background data concerning chemical conditions and phytoplankton levels at five selected locations have been accumulated and in-plant measures for dealing with such problems have been assessed.

A study of the Belwood and Conestogo reservoirs was undertaken to determine spatial differences in the biological

quality of the water in the reservoirs. The purpose of this work was to evaluate the suitability of reservoirs as sources of water for municipal use and to determine optimum depths for placement of water intakes.

A total of thirty plots supporting growths of cattails was treated with four herbicides to determine effective rates of application, optimum time for treatment and regrowth potential. This was the first year of a three-year study designed to evaluate the duration of control.

Ponds treated with three aquatic herbicides were sampled at staged intervals to determine the suitability of using treated water for irrigation purposes. The University of Guelph co-operated in this project by evaluating effects on greenhouse plants. Simazine, a soil-sterilant herbicide, was applied to three ponds as part of a program initiated in 1965 to establish the permanency of control achieved following repetitive treatments. Five other ponds were treated with fenac to determine its efficacy against various aquatic plants and to determine possible side effects on bottom fauna and phytoplankton. Diquat was applied to one pond in co-operation with the Bacteriology Branch to study bacteriological effects of herbicide use. The safety of this same herbicide to newly hatched bass fry was demonstrated by experiments established co-operatively with fish hatchery personnel of the Department of Lands and Forests. Two herbicides were tested in the laboratory against a resistant species commonly known as wild celery or tapegrass, but neither proved to be effective in controlling this plant which is a problem throughout portions of the Kawartha lakes system.

Recommendations for aquatic herbicides were made to the annual meeting of the Ontario Herbicide Committee for incorporation into the 1968 edition of the Guide to Chemical Weed Control — Publication 75 of the Department of Agriculture.

A total of 136 permits were issued to authorize the use of aquatic control agents in public waters. These included 116

for algae and vascular vegetation, nine for coarse fish control, nine for mosquito and blackfly larvae and two for leeches. Approximately 700 enquiries on the control of aquatic nuisances were answered, and numerous aquatic plants forwarded to the laboratory were identified.

Field experiments continued on the evaluation of blackfly larvicides. Lower application rates than those used in previous trials were found to be effective.

Fish bioassays were completed on 110 samples, involving 964 determinations. The tests included 48 surface water samples, 44 industrial wastes, 13 pesticides and five miscellaneous chemicals. Taste evaluation tests were completed on samples of fish from Nipigon Bay and Cataraqui Bay, and bass exposed to 2, 4-D herbicide in a controlled experiment at a fish hatchery. Thirty-two memorandum reports outlining the results of toxicity evaluations were prepared, chiefly for the use of the Division of Industrial Wastes.

A total of 28 fish kills were reported during the year, while 25 were reported in 1966. A breakdown of causes for these fish mortalities is as follows: industrial wastes 7, pesticides 4, water level reductions 5, unknown 9, and miscellaneous 3. Estimates of fish involved in the individual kills ranged from several hundred to several thousand. Game fish were involved in 10 cases.

Numbers of samples collected and received by the biological laboratory increased 117% over the preceding year and the number of determinations increased by 130%.

TABLE III

The following table summarizes the analytical program.

	Summary of Samples Received	Determinations Completed	
ALGAE COUNTS	3,559	ALGAE COUNTS	3,018
BIOASSAYS	110	BIOASSAYS	964
ALGAL IDENT.	232	ALGAL IDENT.	94
BOTTOM FAUNA & FISH	2,133	BOTTOM FAUNA & FISH	1,866
PESTICIDE-FISH PREPARATION	420	PESTICIDE-FISH PREPARATION	498
TASTE TESTS	32	TASTE TESTS	52
THRESHOLD ODOUR TESTS	39	THRESHOLD ODOUR TESTS	39
ZOOPLANKTON	520	ZOOPLANKTON	102
MISC. IDENT.	20	MISC. IDENT.	20
TOTAL 1967	7,065	TOTAL 1967	6,653
TOTAL 1966	3,260	TOTAL 1966	2,898

Chemistry I Branch

Main Laboratory

Chemistry I Branch achieved a new peak-production output in response to accelerated requests for analyses of samples. While sample input rose by 34% compared to 1966, the actual number of tests performed showed a 52% increase over the 1966 figures. This increase in tests reflects the continuing requirement on the part of the Commission field staff for more intensive analyses of submitted samples. The increase in samples was most pronounced in those collected from surface waters throughout the Province ('River' samples) and in samples collected from the Great Lakes near the London Field Laboratory, as shown in the tabulation below. Tests showing the greatest increase over 1966 were the various determinations of nitrogen (79%), hardness (76%), sulphates (74%), and phosphorus (65%).

Type	Samples	Tests Performed	
Type	Increase	Section	Increase
SEWAGE	21%	POLLUTION	45%
RIVER	62%		
WATER	18%	WATER	41%
GREAT LAKES		GREAT LAKES	
TORONTO	25%	TORONTO	41%
LONDON	80%	LONDON	90%

The increased analytical capacity of the laboratory was brought about by a combination of the following factors:

- a marked increase in overtime worked, totalling 740 man-days throughout the year;
- higher productivity per man per day through improvements in work-flow organization;

- the automation of a number of high volume tests. It should be noted that a 19% savings in operating costs per test was realized, in comparison to 1966.

While some of the automation of tests was accomplished through instruments manufactured by laboratory staff (Dissolved Oxygen Meters) a major advance was obtained through employment of 'AutoAnalyzer' instrument assemblies.

The AutoAnalyzer is a modular instrument whose various components are assembled appropriately for a given test, which automatically passes a sample through a series of analytical operations similar to those employed in manual analyses, finally producing the test result as a peak on a graph. The instrument is applicable to almost all colorimetric tests, which makes it particularly appropriate for this laboratory's operations.

The development of these instruments at the main laboratory will make possible the extension of their use to the field laboratories in the coming year.

Other special projects undertaken during the year included analysis of reference samples for anionic detergents for the Analytical Reference Service. This agency uses many U.S. and Canadian operating laboratories to evaluate the reliability and precision of present and tentative standard methods of analysis. Their evaluation of the results obtained is in preparation.

Development of laboratory operations included a thorough review of techniques in use for processing samples and analytical reports throughout the main laboratory. The improved methods adopted resulted in a more rapid and effective processing of work through the various sections. Planning of improved laboratory layouts included the improvisation of laboratory bench arrangements to carry out current workload expansion, and the completion of renovation plans for the entire Branch which incorporated the above improvisations in a permanent form. The renovations, which began in October,

will result in a reorganized laboratory layout which will make better use of existing space to carry forward the pronounced expansions in workload. Planning was begun on an addition to the present laboratory building and on the formation of regional branch laboratories.

Great Lakes Laboratories

Two field laboratories, one in London and the other located in the basement area of the main laboratory in Toronto, continued to fulfil the needs of the IJC Great Lakes Survey.

During the two previous years of this program, difficulties had been experienced in maintaining an even flow of samples to the laboratory, due to the vagaries of the weather and its effect on the sampling program. Since the 1967 sampling program constituted the final stage of the survey, the necessity of meeting the approaching IJC report deadlines made it imperative that the required volume of analytical data be developed within the limited time remaining. The laboratory staff endeavoured to meet these needs by arranging to work on a seven-day work week basis, and, in addition, frequently worked overtime during the regular work days. As a result of these arrangements, 51% more samples were processed in 1967 compared to 1966. The number of samples submitted totalled 5,762 in London, and 4,616 in Toronto. Tests performed amounted to 102,100, equivalent to a 64% increase over the 1966 program.

The analytical data generated by the Great Lakes Program was again reported in a format suitable for computer storage. The experience gained from this aspect of the Great Lakes' program has proved invaluable in providing background experience to our Branch staff currently engaged in assisting in the development of a computer system to handle the main laboratory analytical results.

A preliminary examination of the chemical analytical data obtained from the Great Lakes Surveys to date has shown correlations among the results which indicate the presence of

distinct patterns in the quality of water within each of the Great Lakes, especially in Lake Erie. Computer analysis of the data will provide the means of confirming the presence or absence of these patterned gradients of constituent levels; consequently, the computer analysis reports are awaited with great interest.

In addition to the Great Lakes samples, approximately 2,024 regional samples were analysed by the London laboratory. These regional samples, which required 10,192 tests, would normally have been analysed at the main Toronto laboratory, and, consequently, it can be seen that this reserve analytical capacity proved its worth during the more extreme pressure periods at the Toronto laboratory.

Special Projects

Members of the laboratory staff, who represented the Commission on the Great Lakes Committee on Methodology, continued with the program instituted the previous year of preparing and distributing standard samples among the Canadian agencies engaged in Great Lakes work. The purpose of this cooperative study was to assess the merits of the analytical procedures being used by the participating agencies and to establish whether the laboratories were obtaining comparable results.

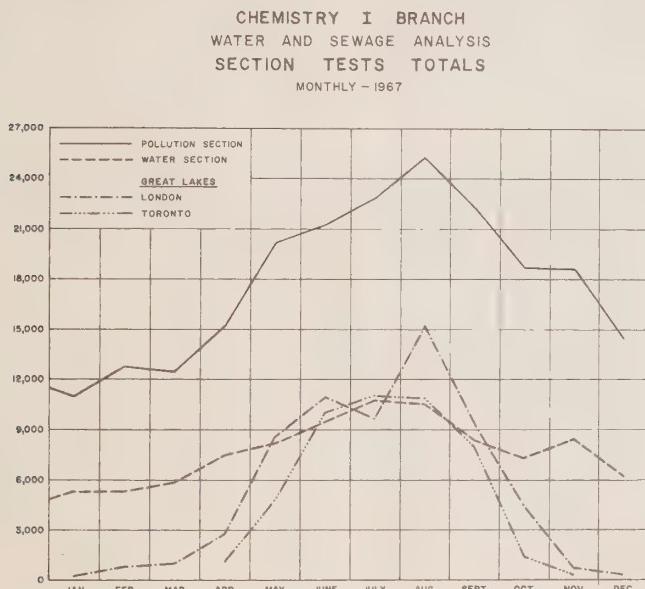
At a meeting in April, 1967, the OWRC Directors' Committee on E.D.P. authorized the formation of a sub-committee composed of members of various divisions to work on developing procedures for computer processing of laboratory analytical data. The sub-committee's report, which was tabled in December, helped to define some of the problem areas associated with the changeover from a manual to a computer operation. Another important aspect of the sub-committee's work was the formulation of standard nomenclature to define all the common sources and types of samples handled by the Commission. The deliberations of the sub-committee also brought to light the varying needs of the different OWRC divisions with respect

to the type of information that should be stored in the proposed computer system and the most suitable coding format for effective retrieval of the stored data.

The laboratory facilities at London will be expanded in 1968 in order to handle a major portion of the samples generated from District #1 by the divisions of Sanitary Engineering and Plant Operations. A detailed scheduling of the sample sub-

missions to the laboratory has been devised to maintain an optimum input of samples.

The following graphs and tables illustrate the sources of samples received for chemical analysis, their seasonal distribution and the contribution of each laboratory section to the record 52% increase in total Branch output achieved this year. The pronounced peaks from May to August are characteristic of the Branch's work.



SECTIONS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL TESTS	TOTAL %
POLLUTION	11,597	12,537	12,280	15,082	20,471	21,116	22,116	25,212	22,471	16,880	18,857	14,738	214,957	81.0 %
WATER	5,324	5,312	5,936	7,424	8,149	9,428	10,492	10,314	8,586	7,303	8,589	6,209	93,066	22.1 %
GREAT LAKES	118	762	979	2,933	8,430	10,962	9,482	15,154	9,610	4,728	1,084	576	64,718	15.3 %
LONDON	-	-	-	1,048	4,982	10,045	10,579	10,806	8,112	1,854	552	-	47,574	11.6 %
TORONTO	-	-	-	-	-	-	-	-	-	-	-	-	-	-

FIGURE IV

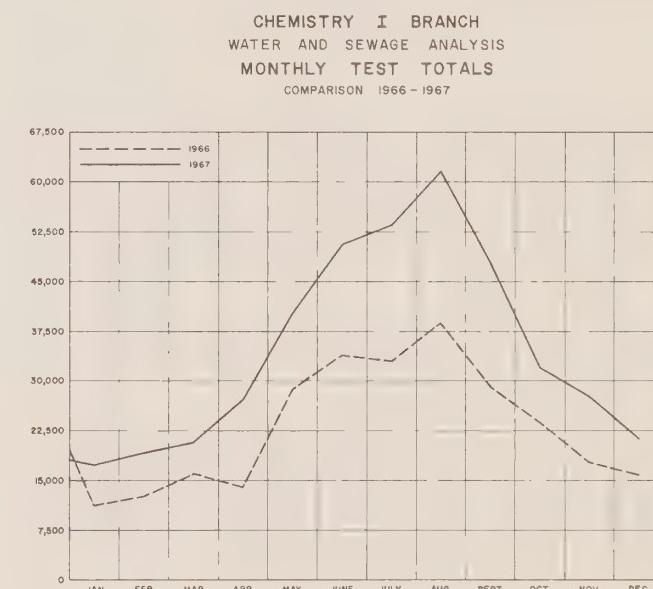


FIGURE V

Chemistry II Branch

Industrial Waste and Organic Analyses

The year was one of major progress in all areas of the program projected for the Chemistry II Branch. The structure of the Branch was organized to form several specialized groups to operate on all major aspects of industrial pollution. To operate these groups, new professional and technical staff were added, and, to supplement their work, several new pieces of equipment were acquired, giving the laboratory much broader scope and increased reliability. New methods were developed and others revised, to help the laboratory handle increased numbers of samples as well as increasingly complex analyses.

This year, the number of samples submitted for routine industrial waste analyses showed a marked increase, with more than 21,000 tests completed — an increase of 56% over the previous year. (See Figure VII).

The inorganic laboratory was greatly helped by the purchase of an atomic absorption spectrophotometer (AAS), which was used for the routine analyses of ten metals. The development of new and simplified methods for several anions and cations also assisted in coping with the volume of analyses.

In the organic laboratory, new techniques and methods resulted in several complex analyses being made routine. Various trace organics were determined, using a wide variety of instrumentation and techniques, including gas chromatography, thin-layer chromatography, and ultra-violet and infrared spectrophotometry. The Great Lakes Survey was aided by the Branch, mainly with chlorophyll determinations and with determinations of trace organics by carbon adsorption techniques.

Many special projects were undertaken this year, most of them leading to increased capacity of the laboratory or improved sensitivity and precision of various tests. The introduction of the AAS technique greatly improved the flow-through time by providing fast methods for the determination of several trace metals, as well as by allowing free capacity for polarography and spectrophotometry to cope with the increasing number of uncommon tests. Studies conducted in connection with enhancement effect in AAS and a comparative study of digestion procedures and their applications led to increased sensitivity in AAS and more reliable determinations in general. Extensive work has been done to extend the detection limit of cyanides, sulphides, sulphites, and other toxic anions.

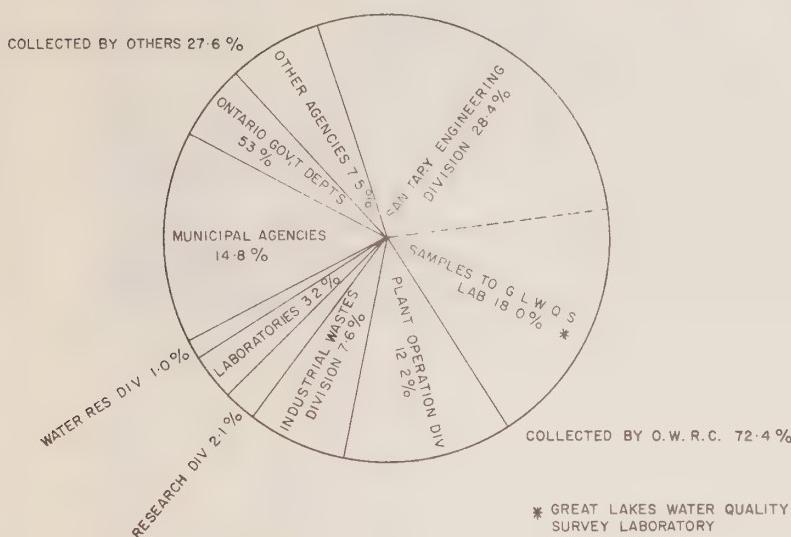
The carbon adsorption apparatus for concentrating organic materials in water was greatly improved by the construction of new field units and by systemizing the analytical and administrative work required in such studies.

The trend towards better contact with industry and other laboratories was continued. By having staff attend seminars, lectures and conferences concerning fields related to the Branch's work, it was possible to keep abreast of contemporary developments in most areas of analytical chemistry. Various visits were made to universities and industries to help extend the Branch's analytical capabilities, and several reciprocal visits by professional people from outside the laboratory took place.

This year, considerable work was done on the Analytical Reference Service (ARS) surveys. The laboratory co-operated in three studies, and the published results indicated that its results were consistently high in accuracy when compared with other participating laboratories.

Samples received for chemical analyses by both chemistry branches are shown in Summary of Sources, Figure VI. Figure VII illustrates the number of tests performed by month, with comparative information for 1966.

SUMMARY OF CHEMISTRY SAMPLE SOURCES



	1966 Samples		1967 Samples	
	Number	(%)	Number	(%)
Collected by OWRC Staff				
Sanitary Engineering				
- Main Laboratory	10767	25.0	16399	28.4
- G.L.W.Q. Survey Lab.	6887	16.0	10378	18.0
Plant Operations	6462	15.0	7031	12.2
Industrial Wastes	3413	7.9	4362	7.6
Research	1368	3.1	1170	2.1
Laboratories	944	2.1	1858	3.2
Water Resources	373	0.9	571	1.0
OWRC Total	30214	70.0	41769	72.4
Collected by Others				
Municipal Agencies	6420	15.0	8541	14.8
Ontario Government Agencies	3136	7.1	3099	5.3
Others	3370	7.9	4311	7.5
Total	12926	30.0	15951	27.6
ANNUAL TOTAL	43140	100.0	57720	100.0

FIGURE VI

CHEMISTRY II BRANCH — MONTHLY TESTS PERFORMED

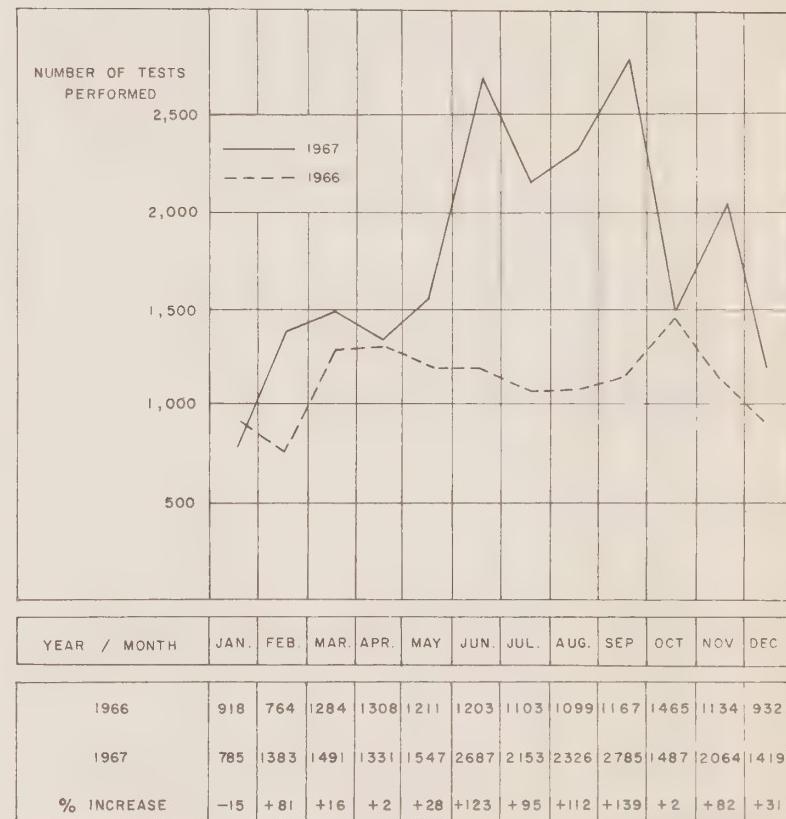


FIGURE VII

DIVISION OF PLANT OPERATIONS

D.A. McTAVISH Director C.W. PERRY Assistant Director

The Division of Plant Operations supervises the operation of all water and sewage works financed and constructed by the Commission. By the end of the year, there were 293 projects operating in 186 municipalities and 7 industries (municipal: 121 water, 167 sewage; provincial: 3 water, 2 sewage). A total of 276 operators were on staff at the year end.

ADMINISTRATION

The Division becomes involved in each project during its design stages. Reports, plans and specifications submitted by consulting engineers are reviewed by this Division in conjunction with other divisions to ensure the provision of suitable works.

For purposes of administration, the Province is divided into six regions which are shown in Figure 1 and the projects in each region are the responsibility of a regional operations engineer. The operations engineer prepares estimates of the operating costs, determines staff requirements, ensures that adequate preventative maintenance of equipment is practiced, and that the process provides the maximum possible treatment, and maintains liaison with local officials.

A maintenance section, consisting of mechanical and electrical technicians and technologists, assists the operations engineer in establishing adequate maintenance programs. A project services section, including a statistical group, assists in process problems and maintains data on the operation.

The operations engineer reports to a supervisor, who, by participating in the development of the policies established at divisional level, ensures a high standard of operation.



THE WATER TREATMENT PLANT LOCATED AT GRAND BEND FOR THE LAKE HURON WATER SUPPLY SYSTEM

The glass enclosed section in the foreground houses three high lift pumps and appurtenances, each rated at 12.3 million gallons per day. The water is pumped through 30 miles of 48 inch diameter pipe to a terminal reservoir at the outskirts of London.

The low portion of the building, in the immediate foreground, contains the foyer, offices, laboratory, control center and electrical room, while the section in the background encloses the 12 rapid sand filters.

PROVINCIAL WORKS

Two major water supply schemes, the Lake Huron Water Supply System and the Lake Erie Water Supply System, were placed in operation during the year. These works were financed by the Province and participants in the scheme are charged on a use basis for the water supplied.

The administration of these works is provided by an engineer-manager. The engineer-manager is responsible for ensuring that an adequate maintenance program is provided for the works and that a quality water is produced. He is also responsible for the maintaining of liaison with participants in the schemes and for establishing communication with prospective participants.

PROJECT SERVICES SECTION

The Project Services Section investigates field operating problems, evaluates operating results, appraises new chemicals or processes, reviews plans and specifications for new projects, prepares yearly summary reports on process operation, and prepares special reports. The Project Services Engineering also supervises the activities of the Division's Statistical Section.

During the year, papers were prepared and presented at various Commission functions and at the Canadian Institute on Pollution Control annual conference. Summary reports were prepared on the operation of water pollution control plants, and water treatment plants, operated by the Division.

Studies continued on the use of synthetic polyelectrolytes to replace lime and ferric chloride in conditioning sludge prior to vacuum filtration. As a result of these studies, cationic polyelectrolytes have replaced the inorganic chemicals at the Division's two raw primary sludge vacuum filter plants at Port Dover and Sault Ste. Marie. However, the various polyelectrolytes evaluated have not, to date, proven to be economical in conditioning a digested mixture of primary plus waste activated sludge. In co-operation with the Division of Research, a study was carried out at the Brampton-Chinguacousy WPCP to further evaluate the use of anionic polyelectrolytes in enhancing primary clarification. The results were not as promising as the study conducted in 1966 at the Lakeview plant.

The plant performance records kept by the Statistical Section and the use made of these records were reviewed. As a result, some forms were changed to permit wider use by Commission personnel, while the compilation of other records was suspended since they were not being used. A committee chaired by the Project Services Engineer formulated recommended minimum requirements for laboratory analyses and process records to be maintained for all OWRC operated water pollution control plants.

In addition, assistance was given to operating personnel in assessing difficult operating problems and reviewing plans and specifications of unfamiliar types of treatment processes. Several divisional reports were prepared on varied subjects including repair and maintenance costs, aerator power usage, odour control chemicals, and plant responsibility levels.

TECHNICAL SERVICES SECTION

Maintenance

High standards of maintenance and a preventive maintenance program are necessary to protect the Commission's capital investment and to ensure continuity of treatment processes at all projects. The Technical Services Section is responsible for this phase of the Division's activities. Its main functions are inspection, supervision, training, troubleshooting and the establishment of sound preventive maintenance procedures at all projects.

The Regional Maintenance Coordinators responsible for this program are supplemented by a highly trained staff of specialists skilled in the fields of electronics, instrumentation, industrial controls, flow measurement, hydraulics, heat transfer and electrical equipment repair.

The priority program of inspection instituted in 1966 designed to minimize interruptions to treatment due to major equipment breakdown is serving its purpose and is being met with approval from the operating personnel. A revised system of reporting inspections, repairs and problems has greatly improved the Division's communications and information facilities.

Equipment Evaluation

The priority program and the revised system of reporting past performance, maintenance data and operating information form the basic source of information for the evaluation of

equipment. Electronic data processing equipment using this information will render valuable assistance in the selection of future materials and equipment for new projects and in the preparation of specifications for this material and equipment.

Safety

The safety program was continued at all projects, with special emphasis being placed on training of plant personnel in safe working practices and demonstrations of safety methods and procedures.

A great deal of interest is being shown in the Division's Operators' Safety Manual by water utility authorities in Canada and the United States. The manual is under constant revision to reflect new safety legislation by provincial government departments.

Close liaison with the Department of Energy and Resources Management resulted in an acceptable standard for the design of heat exchanger control and piping trains for the utilization of digester gas in OWRC plant gas burning equipment.

Formal safety lectures and demonstrations were given at Commission-sponsored training courses. On-site training and inspections of Commission projects continued.

There were no fatalities or permanent injuries to any of the Commission's plant staff during the year.

A comparative table for the years 1963 - 1967 showing disability injuries, frequency and severity rates of accidents follows:

Year	Disabling Injuries	*Frequency Rate	**Severity Rate
1963	6	17	180
1964	37	35	440
1965	30	33	351
1966	36	26	256
1967	35	17	260

*Frequency Rate — Disabling injuries per million man-hours worked.

**Severity Rate — Man-days charged to disabling injuries per million man-hours worked.

REGION I

Thirty-nine projects were in operation during 1967 in Region I. Five are water treatment plants and 12 are sewage treatment plants. The balance of the projects are either water distribution systems or sewage collection systems. One new project was brought into operation during the year. Construction proceeded at two projects in Kent County — Wallaceburg and Chatham.

Enlargements were at various stages of planning for the Union Water System, the Colchester-Harrow water system, the Dresden water plant, and the Tillsonburg sewage plant.

Twenty-five new projects were at various stages of development as provincial projects.

Region II

Thirty-eight projects were in operation during 1967; of these, 13 were treatment facilities and the remainder consisted of distribution or collection facilities. Three reports on expansion to existing facilities were initiated during the year. One report was received on the Dunnville Regional Water Supply System dealing with modifications to the plant facilities. New construction in the region was limited to a start being made on the expansion of the collection system into the Borden area of Port Colborne.

REGION III

Thirty-seven projects were in operation during 1967, twenty of which were treatment facilities and the remainder distribution or collection systems.

The Mitchell, New Hamburg and Waterloo projects were under expansion in 1967. The Mitchell and New Hamburg projects will be completed early in 1968 and the Waterloo expansion will be completed late in the fall of 1968.

Plans have been initiated to expand the facilities at the Fergus and Galt projects. It is expected that construction will commence sometime in 1968.

REGION IV

Seventy-four projects were in operation during 1967. Of these, 24 were sewage or water treatment facilities, 12 were well installations and the remainder were collection or distribution systems.

Enlargements to the Lakeview WPCP and the Brampton/Chinguacousy WPCP, both on the fringe of Metropolitan Toronto, were completed in 1967.

Work was begun on secondary treatment facilities for the Orangeville WPCP.

REGION V

There was a total of 60 projects in operation in Region V in 1967, of which 42 represented treatment or pumping facilities requiring regular supervision on either a full-time or part-time basis. The remainder of the projects represent either water distribution or sewage collection facilities. Eleven waste stabilization ponds were in operation by the end of the year.

Discussions were held with four municipalities - North Bay, Coniston, Newcastle and Fenelon Falls - regarding project expansion, and plans were completed for the enlargement of the existing treatment plant at Markham. Projects were under construction at Moosonee, Haileybury, Port Perry and the township of Mountjoy.

REGION VI

In 1967, a total of 36 water or sewage treatment facilities were in operation in municipalities in Region VI.

There were eight waste stabilization ponds, two primary treatment plants, three activated sludge treatment plants and one trickling filter plant in operation in the region. Plans were underway for the enlargement of two waste stabilization ponds that were overloaded largely due to industrial wastes.

The final settling facilities were being enlarged at one activated sludge plant, and plans and specifications were being prepared for an enlargement of secondary treatment facilities at the same plant. Preliminary plans were completed for the enlargement of two secondary treatment plants. Construction was also well underway in the City of Cornwall on the first provincially-financed primary sewage treatment plant.

There was a total of 14 small water treatment facilities in operation in Region VI in 1967. These facilities ranged from a deep well water supply system to surface water systems, providing chlorination only, with three plants providing water filtration, coagulation, etc. Two new water plants commenced operation in 1967.

STATISTICAL SUMMARY

Statistics indicative of the Division's program follow:

- (A) Total Capital Cost of works in operation as of December 31, 1967:

MUNICIPAL AND PROVINCIAL	
Sewage Projects	\$ 94,161,316
Water Projects	60,796,603
TOTAL.	\$154,957,919

Capital value of works which came into operation in 1967:

MUNICIPAL AND PROVINCIAL	
Sewage Projects	\$ 7,034,719
Water Projects	11,944,544
TOTAL.	\$ 18,979,263

(B) PROJECTS IN OPERATION

MUNICIPAL

Year	Water	Sewage	Total	Increase
1958	9	6	15	—
1959	21	13	34	19
1960	32	33	65	31
1961	53	58	111	46
1962	74	81	155	44
1963	85	106	191	36
1964	96	134	230	39
1965	105	150	255	25*
1966	112	159	271	16**
1967	121	167	288	17

PROVINCIAL

1967	3	2	5	—
------	---	---	---	---

*There were 26 new projects started, less one termination
60-S-58 (Chelmsford).

**There were 19 new projects started, less three terminations
57-S-1, 61-S-78, and 63-S-138 (all in Toronto Twp.)

(C) TOTAL OPERATING COSTS OF PROJECTS

MUNICIPAL AND PROVINCIAL

WATER	\$ 929,943
SEWAGE	2,879,058
TOTAL	\$3,809,001

(D) TOTAL OPERATORS ON OWRC PAYROLL:

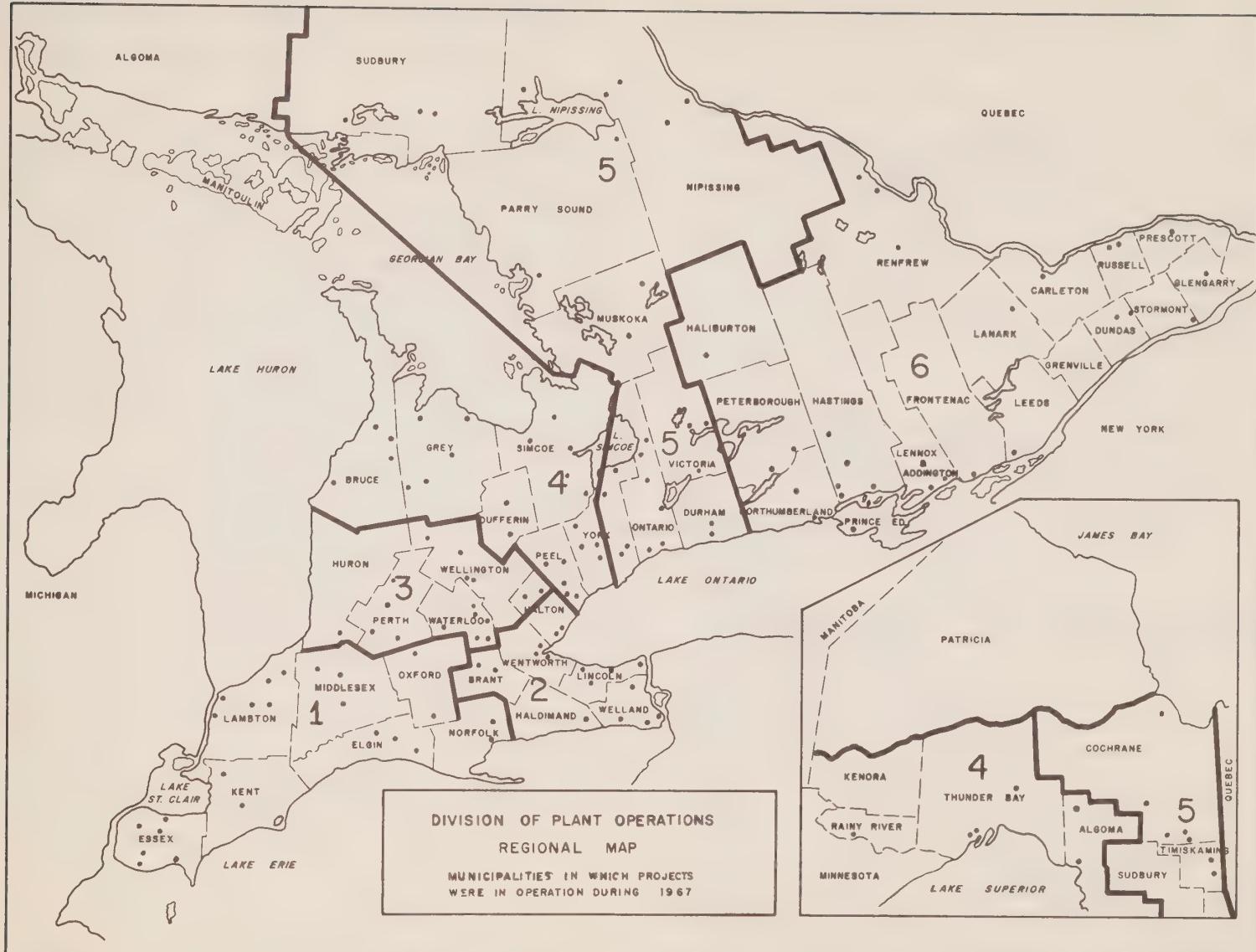
MUNICIPAL

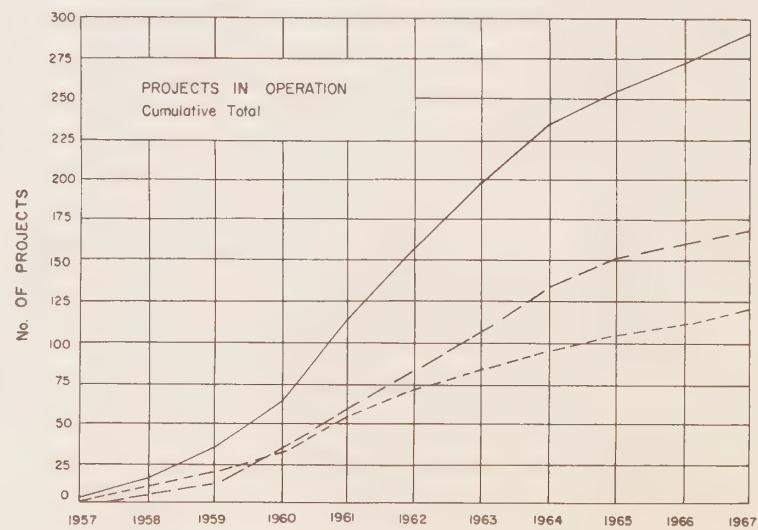
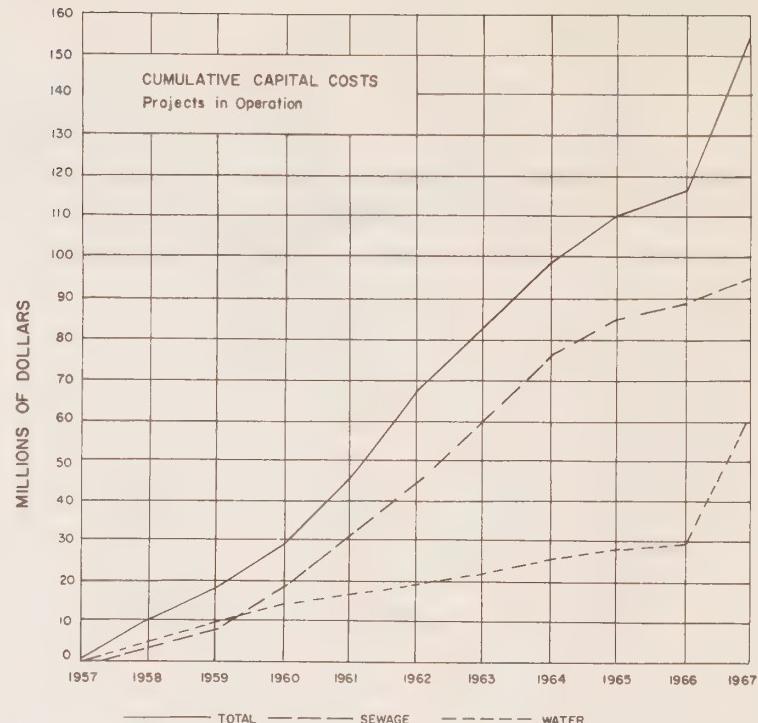
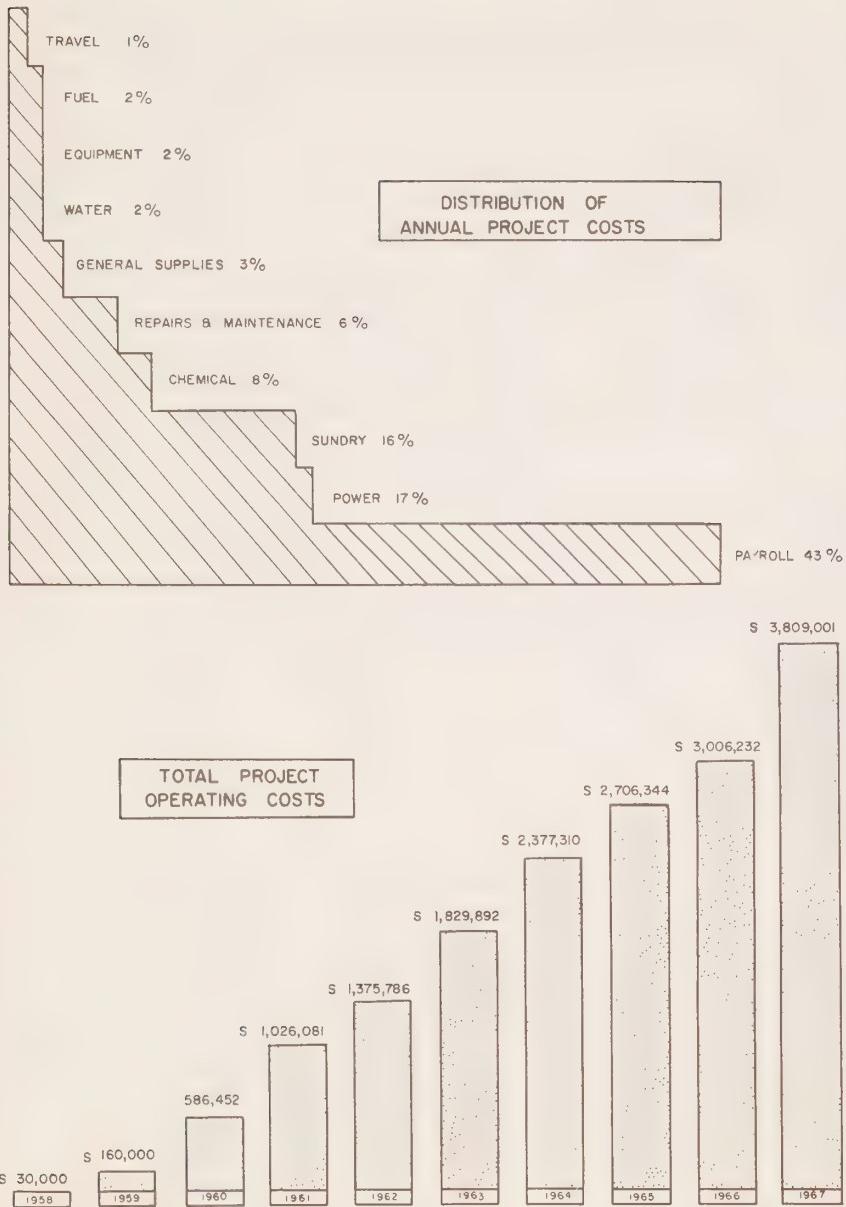
1958	15	1963	191
1959	22	1964	210
1960	92	1965	231
1961	145	1966	239
1962	162	1967	259

(Water Systems Operators - 44; Sewage Plant Operators - 215)
20 of these were part-time operators.

PROVINCIAL

1967	17 (all water systems operators)
----------------	----------------------------------





DIVISION OF PROJECT DEVELOPMENT

P.G. COCKBURN Director L.F. PITURA Acting Assistant Director

The Division of Project Development is responsible for facilitating the development of municipal sewage and water works projects under Section 39 of The Ontario Water Resources Commission Act and for the development of provincially-owned sewage and water works facilities for municipalities under Sections 16a and 16(1)d of the OWRC Act. The Division is divided into three branches, Administration Branch, Projects Branch and Property Branch. The Administration Branch directs and co-ordinates the activities of the Division. Detailed reports on the duties and work completed in 1967 by the other two branches is described further in this report.

The most significant factor in the Division's operations during the year was the extension of the terms of reference for provincially-owned facilities. This enabled the Commission to provide local sewers and watermains for small municipalities, in addition to the major works, such as water intake and water and sewage treatment plants, which can be provided for municipalities wishing to take advantage of this service. Approximately sixty municipalities have accepted this new concept for further development by the Commission. The main principle in the provision of provincially-owned facilities is that the municipalities pay charges related to usage for the service rendered, but the ownership of the facilities remains with the Province.

Projects Branch

The Branch is responsible for developing:

(a) OWRC/municipal sewage and water projects and (b) provincially-owned sewage and water programs. The development of new OWRC/municipal projects remained at near the same level as the previous year. The workload with respect to provincially-owned programs increased considerably since many of the 1966 programs reached the stage where firm proposals including agreements were presented to many municipalities. The statistics and details pertaining to each type of project development follow.

(a) Municipal Projects

During the year, 31 municipal projects were accepted by the Commission, consisting of 19 sewage projects at a total estimated value of \$4,148,979 and 12 water projects at a total estimated value of \$1,908,066. A tabulated summary of the development of municipal projects follows.

	NEW PROJECTS REQUESTED	NEW PROJECTS ACCEPTED	PRELIMINARY AGREEMENTS EXECUTED	FINAL AGREEMENTS EXECUTED	RATING PROPOSALS PREPARED	FINAL STATEMENTS PREPARED	OMB NOTICES PREPARED	HEARINGS
JAN.	3	-	2	1	2	1	-	2
FEB.	2	1	4	1	4	1	2	-
MAR.	1	6	-	-	4	2	1	-
APR.	3	2	3	-	3	1	4	1
MAY	2	3	2	4	3	3	3	2
JUNE	6	4	1	3	4	3	1	1
JULY	-	2	2	-	1	2	2	1
AUG.	-	1	4	1	2	4	4	2
SEPT.	2	3	2	2	1	2	2	1
OCT.	5	2	1	4	4	4	4	2
NOV.	1	5	-	3	3	5	1	-
DEC.	2	2	2	3	2	2	1	-
TOTALS 1967	27	31	23	22	33	30	25	12
TOTALS 1966	29	26	28	30	32	27	24	9
TOTALS 1965	35	33	31	35	34	27	26	15

Although there was no marked increase in the number of projects developed, there was more difficulty in establishing equitable rating structures because of the higher construction costs for most projects.

(b) Provincial Programs

There were 190 programs in various stages of development during the year. These consisted of 145 sewage works programs at an estimated value of \$118,500,000, and 45 water works programs at an estimated value of \$23,000,000, totalling \$141,500,000 as compared to \$61,000,000 at the end of 1966. The above figures do not include regional programs which are reviewed later in the branch report.

A tabulation of pertinent statistics related to the development of the program is provided below.

STATISTICS - PROVINCIAL PROGRAMS

	1967	Cumulative Total
Applications Received for Sewage Works	65	146
Applications Received for Water Works	26	48
Provincial Programs Accepted by Commission	86	184
Total Provincial Programs (Excluding Regional Studies)	91	190
Engineering Agreements Executed for Retaining Consulting Engineers (Design Report)	40	102
Municipalities Participating in the Provincial Programs (Excluding those municipalities involved in Regional Studies)	70	173
Reports Received from Consulting Engineers (Draft, Preliminary, Final Design)	73	113
Tentative Rates Approved by Commission	51	63
Agreements for Final Design Executed	12	14

During the year the drafting of new agreements and by-laws for application to these programs was completed to include the latest revisions of policy and also to simplify the procedures to assist the municipalities in their understanding of the arrangements. In conjunction with the agreements, the

Branch legal officer prepared forms of Commission debentures to be issued to the Central Mortgage and Housing Corporation to enable the Commission to avail itself of the favourable loan arrangements under the National Housing Act for sewage works projects. The acceptance of the form of debenture will not only assist new programs, but will now enable the Commission to acquire existing sewage works which were financed initially by municipalities in co-operation with the Central Mortgage and Housing Corporation.

(c) Regional Programs

Regional programs have been separated from the above category because of their special conditions and extensive areas of proposed servicing with water or sewage works. During 1967, three additional regional programs were under development, making a total of seventeen. In view of the scope of these proposed programs, a brief report on each program is presented below.

Amherstburg-Anderdon-Malden Area Water Supply System

The proposed water service rate and by-laws were submitted to the three municipalities for the provision of filtered water, and it was anticipated that a meeting with the participants will be held early in 1968.

Belleville-Trenton Area Water Supply System

Tentative proposals were presented to the municipalities in June for the provision of filtered water, and the majority of the possible participants indicated that they were not in favour of further development of the program.

Bleizard Valley Area Water Supply System

The engineering report was received at the end of the year and an interim report was issued by the Commission to the Sudbury area municipalities which were included in the study. It is planned to have the rating proposal submitted to the municipalities early in 1968.

Southern Kent County Area Water Supply System

A revised proposal for supplying filtered water to the participating municipalities was presented in December and it was anticipated that the decisions of the municipalities will be known early in 1968.

Kingston Area Water Supply System

The engineering report was nearing completion at the end of the year. It was scheduled for submission to the Commission in January, 1968. Subsequently, a proposal will be initiated for presentation to the area municipalities.

Western Lambton County Water Supply System

During the year, the City of Sarnia retained a consulting engineer to prepare a plan for providing water to the adjacent municipalities as an alternative to the Commission's proposal submitted late in 1966. A meeting was attended by representatives of the Commission in Sarnia in December, 1967, to hear the city's proposal. A comparison of the alternatives was under review by staff at the end of the year.

Lake Timiskaming Water Supply System

Proposals were submitted to the Town of Haileybury and the Township of Bucke in November and it was anticipated that the municipalities would accept the proposed arrangements. A portion of the final design of the system was underway at the end of the year as a result of commitments made to the Commission by the municipalities.

Lincoln County Area Sewage Works System

A tentative proposal for providing sewage service to the area was presented in June. As a result of the indications received from the proposed participants, draft agreements were under preparation at the end of the year for submission to the municipalities early in 1968.

Lower Grand River Area Water Supply System

The development of the program was being held in abeyance as a result of indications received from the possible

participants in the system.

Middle Grand River Area Water Supply System

The first report on the engineering study was received in October and the review was completed at the end of the year.

Southern Peel County Area Water and Sewage Works System

Negotiations concerning the proposed agreements continued with several of the municipalities. It was planned to hold a meeting with all participants early in 1968.

Tilbury Area Water Supply System

Proposals including service rates and by-laws were submitted to the participants in November. Based on indications received by the end of the year, a meeting will be held with the participants early in 1968.

East Welland County Area Water Supply System

A proposal was presented to the municipalities in June. As a result of indications received from the participants, further development is being held in abeyance.

Central York County Area Water and Sewage Works System

An engineering report on the proposed systems was received and reviewed during the year. Meetings have been held with area municipalities and it is planned to present a proposal to the municipalities in the first half of 1968.

Lake Erie Water Supply System

In December, a revised proposal was submitted to the City of St. Thomas for the supply of filtered water from the system.

Lake Huron Water Supply System

The system went into operation in 1967 to supply the City of London. Several proposals were being developed for supplying water from the system to adjacent municipalities.

Napanee-Deseronto Water Supply System

The program was being held in abeyance as a result of indications received from the municipalities.

Property Branch

The year 1967 saw this Branch's land acquisition program for regular Commission-municipal projects increase sharply, with the number of property acquisitions being approximately five times that of the previous year.

The majority of the work in connection with Provincial programs was centered on completion of property work on the Lake Huron System, substantial completion of the Lake Erie System, and the commencement of work on the Southern Peel County sewage and water works program.

In addition to land acquisition, reviews were also undertaken during 1967 of the method of valuing existing water and sewage plants required for future projects and of taxation policies on Commission-owned projects. A program of preliminary property inspection was instituted for the Provincial programs to assist the Division of Sanitary Engineering in providing information to public hearings on proposed sewage work locations.

A taxation appeal concerning the assessment of sewage lagoons in New Liskeard was heard by the Ontario Municipal Board during May and October, with the decision being given in favour of the Commission. One expropriation was heard before the Ontario Municipal Board during 1967, with the award being in accordance with the Commission's offer.

During the year, increased use was made of the Board of Negotiation as set up under the Expropriation Procedures Act, with two settlements reached following the Board's recommendation.

The statistics for the Branch were as follows:

STATISTICS

Properties

Properties under negotiation at end of December 31, 1966	35
New properties listed for acquisition during 1967	257
Options obtained or property otherwise acquired	255
Properties under negotiation as at end of 1967	37

Options

Options held at end of December 31, 1966	168
New options acquired during 1967	124
Deals completed during 1967	177
Options outstanding as at December 31, 1967	115

DIVISION OF RESEARCH

A.J. HARRIS Director

It is the function of the Division of Research to carry out technical and scientific investigations of theory and procedures necessary to provide information with respect to the aquatic environment and with respect to the collection, production, transmission, treatment, storage, supply, and distribution of water or wastewater.

The organization of the Division includes, in addition to the office of the Director, three technical branches: the Applied Sciences Branch, the Technical Advisory Services Branch and the Special Studies Branch.

Research services are provided to all the operative divisions of the OWRC and to management. Research information in the form of memoranda, papers, and reports is circulated to staff and, when formalized as a research publication, is disseminated to university libraries and faculties, consultants in the field of water resources, municipal, provincial, state and federal departments or agencies, industries and any other interested persons. Information is made available to the general public by publication in the trade magazines. Presentations are made at meetings and seminars of professional societies and other organizations.

Applied Sciences Branch

Effective May 15, 1967, the Division of Research was authorized to designate as the "Applied Sciences Branch" that group which was formerly known as the "Field Projects Branch".

It is the function of the Branch to conduct systematic investigations of methods, processes and applicable theory of water and wastewater treatment, using laboratory models and field scale pilot plants. The projects are generally of relatively long duration, of an engineering nature, and of direct value in and to the Province of Ontario.

There were no staff additions or changes during the year, with the complement remaining at two technicians trained in chemistry and instrumentation, and four engineers trained in engineering physics, civil, chemical and mechanical engineering as well as in postgraduate sanitary engineering.

During the year the Branch staff was actively engaged in thirty-one technical projects, fourteen of which were carried over from the previous year. Of these thirty-one projects, sixteen were completed and fourteen publications, (nine "reports" and five "papers") were prepared. Two of the projects resulted in advisory memoranda being sent to the interested divisions within the Commission.

In addition to the technical projects carried out, the Branch supervisor was also appointed "co-ordinator" for the present renovation program for Division of Research and Division of Laboratory facilities, and for the proposed expansion of the building.

The following summary of technical projects carried out during 1967 indicates the multi-disciplinary nature of the work in which the Branch is involved:

**APPLIED SCIENCES BRANCH
1967 SUMMARY**

	PROJECTS CARRIED OVER	NEW PROJECTS STARTED	PROJECTS COMPLETED	RESEARCH REPORT NO.	PUBLICATION PAPER NO.
1	64.6 Supplementary Aeration — Lagoons		X	16	
2	65.2 Effluent Diffusion		X	22	
3	.3 Sludge Density Meter		X		2008
4	.10 Automatic Sampling				
5	.13 Marine Toilets		X		2005
6	.16 Chemical Addition to Activated Sludge		X	15	
7	66.3 Sludge Storage — Primary Clarifier		X	24	
8	.5 Nutrient Removal — Algae		X		2004
9	.6 Effluent Polishing		X	20	
10	.12 Algae Filtration				
11	.14 McMaster				
12	.15 DHO Catch Basin		X	18	
13	.17 High Rate Activated Sludge		X	17	
14	.18 Sludge Disposal		X	23	
15		67.1 Cladophora			
16		.2 Starch Treatability			
17		.4 Biological Reactance			
18		.5 Subsurface Aeration			
19		.6 Filter Media			
20		.7 Oxidation Ditch			
21		.8 Zeta Potential			
22		.9 Activated Sludge Modification - Phosphate			
23		.11 Animal Waste	X	28	
24		.13 Flowing Wells			
25		.14 Water Plant Sludge			
26		.15 Algae Taste and Odour			
27		.16 Ultra-violet Sterilization	X		2012
28		.17 Drilling Fluid	X		
29		.18 Vortex Aerator	X		
30		.19 Ozone			
31		.20 Model Sewage Treatment Plant	X		2011

A more detailed account of these projects is given below:

The Radioactive Density Meter for Sewage Sludge Measurement and Control

The transfer of increasingly large volumes of sewage sludge from primary tanks to digesters and drying process has resulted in the development of sludge density gauges to measure and control the sludge flows. Although some treatment plants may experience difficulties because of local sludge characteristics, installation of density meters should ensure more efficient and less costly digestion and dewatering of primary sewage sludges.

Marine Toilet Facilities

A considerable amount of work was done on behalf of the OWRC Watercraft Pollution Control Program. Some of the activities included:

- (a) examination and testing of four chemical disinfectants and three models of sanitary devices submitted to the Division of Sanitary Engineering for approval,
- (b) evaluation of some 20 samples of organic dyes to find a suitable tracer that could be incorporated with marine toilet additives,
- (c) study to determine the feasibility of employing tracer material in marine toilets to act as a psychological deterrent against over-board discharge of human wastes from pleasure boats,
- (d) establishment of some guidelines for tests to be conducted by commercial testing laboratories on chemical additives and marine toilets submitted for approval.

Sludge Thickening in Primary Clarifiers

An evaluation report prepared as a result of a study of the primary clarifier at the Little River WPCP indicated the use of a central drop section in the primary clarifier to be an efficient method of thickening and holding primary and secondary sludge prior to vacuum filtration.



MODEL
SEWAGE
TREATMENT
PLANT

Phosphorus Reduction by Algal Cultures

Because of the interest that has been given to the use of tertiary detention ponds as phosphorus removal facilities, this Branch prepared a paper summarizing the results of work by others in this regard and presenting the results of field and laboratory studies carried out by this Branch. The paper indicates that the use of tertiary detention ponds employing algal cultures is not an effective method for controlling the amount of phosphorus discharged from wastewater treatment facilities.

Effluent Polishing Process Evaluation

A report was prepared early in 1967 presenting the results of the evaluation of a tertiary retention pond and two slow sand filters as effluent polishing process installations. A preliminary study of a backwash filter indicated it to be an effective effluent polishing facility.

Effect of Algae on Gravity Filters

Algae of the genera *Chlorella*, *Scenedesmus* and *Oocistus* were filtered at varying flow rates through sand, anthracite and mixed media filters. Retention of algae in the filters was generally poor, but a filter of 6-inch Ottawa sand overlaid by 21-inch anthracite appeared to provide the most satisfactory combination of minimum headloss and maximum algae retention. Tests are continuing with the algae *Euglena*.

Aeration Tank Diffusion Study

In September of 1966, a member of the staff of the Technical Advisory Services Branch returned to university for post-graduate studies, choosing as a thesis topic the study of diffusion mechanics in sewage treatment aeration sections. This project was supported by the OWRC through the Applied Sciences Branch.

Catch Basin Efficiency Evaluation

Continued testing of various catch basin inlet grates resulted in the preparation of an evaluation report comparing the efficiencies of six inlet grates. The study indicated the "Rowland" grate to be the most efficient under the test conditions.

High Rate - Combined Tank Activated Sludge Process

Following an inspection tour of existing installations in the Province of Quebec in the winter of 1966, a report evaluating three High Rate - Combined Tank activated sludge process designs was prepared. The report recommended that the High Rate - Combined Tank activated sludge process be approved by the OWRC for acceptance as a municipal wastewater treatment method within the Province of Ontario.

Sludge Treatment and Disposal

A literature survey of various methods of treating and disposing of sewage sludge begun in 1966 was completed in 1967. It was found that the suitability of various dewatering and disposal techniques for a particular treatment plant depends on many factors, including plant location, land availability, population density and sludge characteristics. Dewatering and disposal of sludge may be accomplished by lagooning and drying beds, tank truck haulage, mechanical methods, heat drying and incineration, composting and anaerobic digestion.

Control of Cladophora

A large scale test of an algicide was made during 1967 in an attempt to produce an effective control mechanism for the nuisance algae *Cladophora*. The results indicate that field use of an algicide, even when proven effective in laboratory testing, is subject to interference by currents, water temperature, etc. and may not prove effective.

Biological Reactance Rate Study

Laboratory bench scale tests were initiated in a study of the reactance rates obtainable in the degradation of organic nutrients by bacteria. Artificial substrates composed of single and mixed organic elements were subjected to biological degradation with monitoring of respiration rates. Testing is continuing into 1968.

Subsurface Aeration Systems

The rapid growth of sewage lagoons as an economical biological waste treatment system has been accompanied by wide-spread operational and maintenance difficulties. Sub-surface aeration would seem to provide an attractive solution to these difficulties, especially in Canadian climates, but investigations to date reveal that existing systems suffer from many operational difficulties of their own, and require further development before they can be recommended for general use.

Characteristics of Water Filtration Media

A study of water filter media was undertaken to determine the physical and hydraulic characteristics of those media commonly used under common flow conditions. Testing has been completed and a report is being prepared, including information tables made available by electronic data processing of test data.

Pilot Oxidation Ditch

A pilot oxidation ditch was erected in the laboratory building and has proven to be effective in treating domestic sewage. A tube settler installed in the ditch, in lieu of a final clarifier, achieved clarification of the mixed liquor at a flow rate of 1 gal/min/sq ft opening area and 17 min. retention. The ditch is to be used to study animal waste treatment.

Microelectrophoretic Studies

Experimental work was initiated to study the application of microelectrophoretic techniques and zeta potential data for the treatment of difficult waters by chemical coagulation.

Farm Animal Waste Disposal

A paper has been prepared discussing the factors involved in the disposal of farm animal wastes. As well as indicating the pollution potential of farm animal wastes, in relation to quantity and quality, the paper presents practiced and proposed methods of waste handling, waste treatment and waste disposal.

The Applied Sciences Branch has also been actively involved in evaluating two oxidation ditches which have been installed on farms for treating pig wastes. This evaluation is being made in conjunction with the Ontario Department of Agriculture and Food and the respective farmers involved.

Starch Waste Treatability Studies

Laboratory treatability studies were carried out on representative potato-processing and corn starch manufacturing wastes. The studies indicate that potato wastes are more readily biodegradable than corn starch wastes. A report presenting the results of these studies is being prepared.

Control of Flowing Wells

Work has been initiated into economical methods of controlling water wells where water flows outside the well casing. The desirable solution to the problem would allow controlled passage of water through the casing in addition to plugging off any unwanted flow.

Water Treatment Sludge Disposal

A report is being prepared from a literature survey, reviewing the various methods and problems involved in the treatment and disposal of purification wastes derived from a water treatment plant.

Ultraviolet Sterilization of Potable Water Supplies

A thorough review was made of all the available information published to date in various technical reports, advertising and scientific literature related to the application of ultraviolet irradiation to the disinfection of potable water supplies.

Drilling Fluid Additive

Laboratory tests were conducted on a sample of a new drilling fluid additive to assess its effects on the bacteriological quality of water obtained from any wells where such drilling fluid is employed.

Model Sewage Treatment Plant

A paper was prepared describing a model sewage treatment plant and an oxygen respiration cell, developed and effectively used for several projects by this Division. The equipment described in the paper may be used in determining the treatability of various waste products and establishing design criteria for full scale installations.



Oxidation Ditch Treating Pig Wastes

Technical Advisory Services Branch

The Technical Advisory Services Branch provides technical assistance to other divisions of the Commission and through them to municipalities, in the following areas:

- solving of operating problems at water and wastewater treatment plants;
- establishing of required treatment processes for specific water supplies and wastewaters;
- analysis of the performance of existing water and wastewater treatment plants;
- proof testing of equipment and processes incorporated in newly-built treatment works prior to formal acceptance;
- review of plans for proposed treatment works, submitted to the OWRC Design Approvals Branch, with respect to process design parameters.

The year's activities can be categorized under one or more of the indicated areas. However, for the purposes of this report the various activities are described under three main headings: a) water purification, b) wastewater treatment, c) branch laboratory section.

Water Purification

During the year considerable progress was made in the development of portable pilot plant equipment suitable for on-site use in the evaluation of treatment methods. Most unit processes that are used in the treatment of potable water can now be duplicated on a pilot scale.

Unlike previous years, taste and odour problems no longer constituted the principal workload. As a matter of interest, only three taste and odour problems were investigated, two of which were traceable to algae.

This year, the main workload evolved from problems related to the presence of iron and/or manganese in well waters. There are large sources of water in Central Ontario which can only yield an acceptable water supply if iron and/or manganese are removed. This removal is necessary because a small amount of iron can spoil a supply due to the fact that it can, and does, accumulate in the mains and discharges infrequently but in high concentrations with most objectionable results. During the year pilot plant studies were run on 13 water supplies in order to determine the best method of treatment.

Assistance was given to the Division of Plant Operations at the new water plants at Grand Bend and Southampton and at Warkworth to improve flocculation and decrease carryover of solids.

Through the Division of Sanitary Engineering, technical assistance was rendered to a number of municipalities on the operation and possible improvement of their water treatment works, e.g. filtration at Huntsville and the township of Thorold, fluoridation at Carleton Place, control of taste and odour at St. Mary's and Delhi, and iron treatment with polyphosphate at Stratford.

Work was carried out, in cooperation with the Division of Water Resources particularly, in determining the suitability of new well water supplies at Callander, Township of Hanmer, Port Perry and Rockwood.

Wastewater Treatment

As in previous years a good deal of time was spent on measurement of oxygen transfer efficiency of aeration systems. Coarse bubble diffusers in a cross-roll pattern at Tillsonburg showed a five percent transfer efficiency under process conditions. At Burlington, tests on similar diffusers in a spiral flow tank showed an efficiency of six percent in water taken from Burlington Bay. When fine bubble diffusers were mounted in the aeration tanks at Elora, in lieu of the original coarse bubble diffusers, the transfer efficiency measured in tapwater

increased to seven percent.

Using bench-scale activated sludge units, various techniques were evaluated for the measurement of rate of oxygen transfer and transfer efficiency under process conditions. Results obtained so far have not shown a reliable correlation with transfer efficiency data based on exit gas analysis.

Significant interest was again shown in the oxidation ditch process. The degree of BOD removal from a cannery waste was nearly satisfactory at Tilbury. The new installation at Harriston was tested for aeration capacity of the surface aerator, especially because of recent emphasis on limits of performance of this aeration equipment.

At the request of the Division of Industrial Wastes, an intensive survey was undertaken of specific installations of a combined type treatment system where the aeration basin, settling tank and polishing lagoon are combined into one large basin. Initial results showed the need for certain modifications to achieve satisfactory operation. In cooperation with this Division, treatment problems were investigated on a possibly explosive organic waste, vegetable processing wastes, and a paper processing waste. Attempts were made to improve the performance of an extended aeration plant serving a creamery, and of a newly installed chemical treatment plant serving a large plating and fabricating industry. The effects of tannery wastes on an anaerobic digester were analyzed. Advice was given to effect stable and satisfactory operation of an activated sludge plant treating the wastewater from a creosoting process. A detailed sampling program showed that primary clarification of a potato processing waste could yield a 95 percent removal of suspended solids and 37 percent BOD removal.

Several bench-scale studies were conducted to determine any effects of a particular wastewater on the activated sludge process before the recommendation could be made that this wastewater could be discharged to the sanitary sewer.

Further use was made of bench-scale activated sludge

plants to yield a biologically treated effluent from several organic chemical wastes for toxicity tests by the Biology Branch of the Division of Laboratories.

At the request of the Division of Plant Operations, operating problems with anaerobic sludge digesters were attended to at the Elmira and the Village of Markham treatment plants. At the Brampton-Chinguacousy plant a study was undertaken on the coagulation of raw sewage using an organic polyelectrolyte. In this instance, test results did not show an increase in BOD or suspended solids removal through the primary sedimentation tank. Changes were suggested in the operation of the activated sludge process at Elmira which proved capable of achieving improved treatment efficiency under winter conditions.

Investigations on aerated lagoons were continued. The systems at Kettleby and Chesterville were analyzed, as well as the mechanically aerated lagoon at Durham.

The Division of Industrial Wastes was assisted in the review of process design proposals for the treatment of dairy wastes, potato processing wastes, cannery wastes, distillery wastes and others. Assistance was provided to the Division of Sanitary Engineering with the review of process designs proposed for a number of provincial sewage works programs, as well as for the expansion of the Burlington Skyway plant and for the treatment plants designed for the City of St. Catharines.

Laboratory Section

The Branch laboratory group continued its function of providing the required backup service to the field staff in three main areas: chemical analysis of special samples; development and evaluation of modifications of analytical procedures specially suited for field use, and maintenance and calibration of monitoring instruments.

The chemical analysis statistics showed an increase of approximately 35 percent in the numbers of special samples

received for analysis and a similar increase in the total number of determinations made.

The work on evaluation of modifications of test procedures may be illustrated by the following examples:

Several specific ion electrodes were evaluated. It was found that these systems could measure the concentration of chloride, fluoride, hardness, and sulphide ions accurately. Only the sodium ion electrode has been acquired by the Branch to meet the immediate needs of the field investigations on water supplies.

A thorough revision of the test procedures for suspended solids resulted in much improved precision and accuracy. A special turbidimeter, linear over the range of zero to 500 Jackson Turbidity Units was evaluated as a rapid means of estimating suspended solids in raw and treated wastewaters. Since preliminary results were promising, such a turbidimeter was acquired so that a detailed field study could be undertaken.

Considerable time was spent in the maintenance and calibration of field analytical instruments, e.g. dissolved oxygen (DO) meters and pH meters, not only for the Branch's use, but also for the use of the divisions of Plant Operations and Sanitary Engineering. Two membrane-type DO meters were evaluated. One was found adequate for use in the field. The other was suitable for use in the laboratory and in field tests where an accuracy of ± 0.1 mg/l is required.

Special Studies Branch

The Branch is responsible for carrying out special investigations into lake and stream pollution and treatment processes, knowledge of which is necessary to other engineering-type or life science research programs. The results

are integrated with, or support, various activities of the Commission or the Division of Research.

The assignments require a team approach using highly trained scientists up to the doctorate level in chemistry and the life sciences such as plant physiology, zoology, microbiology and virology. Studies utilizing a wide range of routine and non-routine techniques such as viruses and radioactive materials are conducted in laboratories and in the field.

Examples of some programs are described below.

Studies on Excessive Enrichment of Lakes

During 1966 the first part of a two year study to investigate the causes, mechanisms and results of the productivity of algae was carried out in the Bay of Quinte region at four locations. The purpose of the study is to relate to OWRC problems various techniques developed to measure algal productivity and to investigate the physiological and ecological factors influencing production. Continuous sampling was initiated in March 1967, with additional studies involving the use of radioactive materials being carried out.

Pesticide Studies

Widespread applications of insecticides demanded studies into relationships between these chemicals and algae typically associated with stabilization ponds for the treatment of wastewater.

The insecticides selected - DDT, Sevin and Malathion - represented three major classes of organic pesticides. A report has been issued relating the toxicity of these materials to algae in stabilization ponds. Detoxification trials indicate that although DDT is metabolized by algae in stabilization ponds, the quantity of material converted to less toxic compounds is quite negligible. This is probably influenced by the low aqueous solubility of the pesticide. Studies with the remaining insecticides suggest that a greater conversion of the chemicals by algae may occur.

Organic Industrial Waste Studies

A joint project, involving the Division of Industrial Wastes and the Division of Research, was established to investigate the possible development of useful parameters in evaluating the pollutive aspects of organic industrial discharges.

The initial stage of the study has been focussed on the petrochemical industry and has involved the isolation and identification of materials for which there is not a routine test procedure. Initial studies have been carried out with the aromatic derivative compounds, particularly benzene substitutes. Continuous liquid extraction is employed for initial separation of these organics, with subsequent gas chromatographic, infrared spectroscopic, and ultra-violet absorption spectroscopic techniques. Toxicity limits for these compounds will be subsequently established using bioassay techniques.

Actinomycetes with Respect to Taste and Odour

The growth products of actinomycetes have been implicated in the development of taste and odour in water. Investigations in this study involve the isolation, growth and characterization of growth products from representative species in this group of microorganisms. Thirty different strains were isolated over a period of time and are being maintained. Using this culture collection, experiments were carried out to determine the optimum medium and method for their isolation from various sources. This technique is being currently applied to field samples. Selected cultures will be grown under controlled conditions in an attempt to characterize growth products responsible for taste and odour production in water supplies.

Viruses in Surface Water

There is continuing concern regarding the possible presence of pathogenic and other objectionable viruses in water supplies, and, at present, there is no reliable and simple method for routine monitoring of viruses. A modification of a method for enumerating bacterial viruses in water was developed and used to test

water samples of various types on an experimental scale. A report on its possible application to the monitoring of water supplies was prepared (Research Publication No. 26). The counting method has also been applied in experiments to determine the efficiency of soluble (sodium alginate) filters in the recovery of low numbers of such viruses from water; the results of preliminary studies were compiled in Research Publication No. 25. Filtration with membranes of sodium alginate, an extension of the membrane filter procedure, appears to be both efficient and relatively inexpensive.

Studies of Mud Dwelling Organisms as Indicators of Pollution in Lakes

Several macroinvertebrate communities were identified in the Bay of Quinte and adjacent Lake Ontario based on extensive sampling. Over 100 species (sludge worms, midges, clams etc.) were found in the study area. Continual sampling of five communities was initiated in March 1967 to provide life history data to be used in estimating rates of production of dominant forms. Production rates and species composition in these communities are being related to water quality and import of organic matter to the bottom sediments.

DIVISION OF SANITARY ENGINEERING

J.R. BARR Director G.R. TREWIN Assistant Director

The programs of the Division of Sanitary Engineering are divided into five main categories: (1) the evaluation of plans of proposed water supply and waste-water treatment installations; (2) the inspection, promotion and supervision of water and waste-water treatment plants in the Province; (3) the study and control of pollution in the waterways of Ontario and the monitoring of water quality in both the Great Lakes and other waters in and bordering the Province; (4) the supervision of plumbing and the control of pollution from water craft; and (5) the planning of regional water supply and waste-water treatment facilities.

The five programs are organized and performed by five operating branches. In addition, the Administration Branch directs the Division's activities and provides two staff functions — the planning of the water works program and the sewage works program of the Division.

Of special note during the year was the adoption by the Commission of policy guidelines for water quality objectives. These objectives are designed to ensure that the water resources of the Province are utilized wisely. The program of the Division is being directed to meet this new water management challenge by expanding its surveillance and river basin planning functions.

An important function of the Commission is the holding of public hearings with respect to sewage works. When a municipality intends to install sewage works in another municipality, the Commission, under the requirements of the OWRC Act, must hold a public hearing. In addition, the Commission sometimes holds public hearings (which are not mandatory under the Act) before approving sewage treatment works to be located in the municipality to be served or which are intended to serve a non-municipal need. The purpose of the hearings is to ensure that

the intended works will not adversely affect adjacent properties. In 1967, a total of 48 public hearings were held of which 42 concerned the location of proposed sewage treatment facilities. The remaining six hearings covered proposed storm and sanitary sewer installations in adjacent municipalities. Of special note is the fact that 36 of the public hearings concerned Provincial sewage treatment projects. This program is co-ordinated by the supervisor of sewage works.



A Sediment Sampling

Design Approvals Branch

During the year, the Branch appraised engineering reports, plans and specifications submitted for the approval of water works, sewage works, and certain agricultural waste treatment installations in accordance with Section 30 and Section 31 of the Ontario Water Resources Commission Act.

The projects section made its own appraisals of submissions and co-ordinated those of the other divisions concerned with the processing of OWRC municipal and provincially-financed projects. Liaison was maintained with the Ontario Department of Highways on its plans for highway work to avoid conflict with pending OWRC municipal and provincial water and sewage projects and to effect through the District Engineers Branch the removal of sanitary wastes from highway storm sewers.

The municipal projects section, in addition to processing submissions, made recommendations to the Ontario Department of Municipal Affairs concerning sewage and water works requirements for subdivision draft plans and official plans prepared under Section 26 and Section 12 of The Planning Act.

Requests for information from the public and other Government agencies, as well as special assignments from the Commission, were handled by the Branch.

The statistical section recorded chemical and bacteriological analyses results submitted by the OWRC and the Ontario Department of Health laboratories. Guides on the estimating of sewage treatment and water works construction costs were prepared for printing.

The clerical section prepared and handled the approval certificates for the applications processed by the Branch and by the Division of Industrial Wastes.

Special Assignments

Training was given throughout the year to Colombo Plan Trainees from India and Pakistan on water supply and sewage treatment.

The Branch repeated its fluoridation survey of all municipalities using controlled fluoridation.

A paper on "Municipal Waste-Water Treatment" was prepared and delivered at the Ontario Pollution Control Conference, held in Toronto, December 4 - 6, 1967.

A brief was presented on "The Status of Farm Animal Waste Pollution Control In Ontario" which summarized the Commission's present role in this area of pollution control.

A comparative survey of the various types of sewage pumping stations was prepared and circulated to municipal engineers, consulting engineers, and equipment manufacturers. The findings of the survey will be included in "A Guide to the Selection, Design and Cost of Sewage Pumping Stations" now in preparation.

Certificates of Approval

During the year the Branch processed 2,807 applications, subdivision reviews and engineering reports. These resulted in a total of 1,955 certificates of approval being issued, at a total estimated cost of \$174,430,062.92. In 1966, 1,842 certificates were issued for water works, sewage works and industrial waste facilities at a total estimated expenditure of \$152,996,319.00.

Certificates issued for water works applications totalled 796 and involved an estimated expenditure of \$45,519,615.79, compared with 763 certificates in 1966 at an expenditure of \$42,321,229.00.

In the waste-water field 1,159 certificates were issued during the year at an estimated cost of \$128,910,447.13, compared with 1,079 approvals in 1966 at an estimated cost of \$106,675,080.00.

Of the total certificates issued in 1967, 22 were for OWRC water works projects, and 44 were for OWRC sewage works projects. Estimated costs of the projects were \$6,864,132.15 for sewage works and \$455,063.40 for water works.

Certificates for works to be constructed under Provincial financing issued in 1967 were as follows:

SUMMARY OF WATER AND SEWAGE WORKS APPROVALS

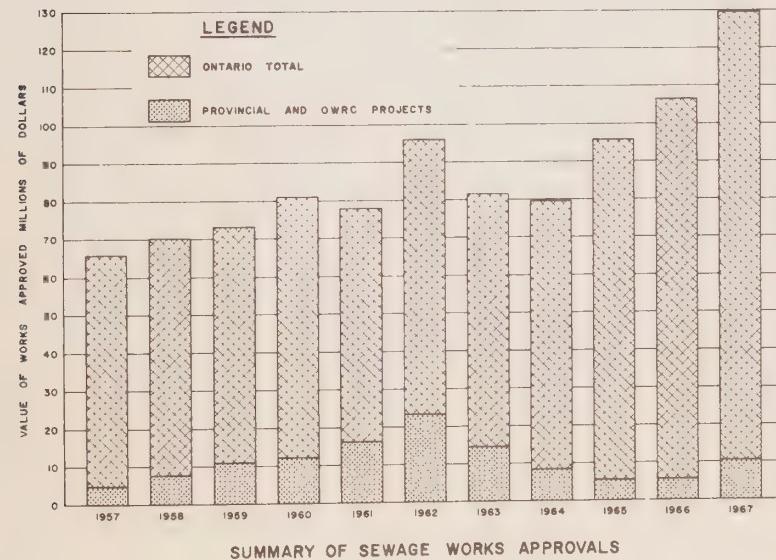
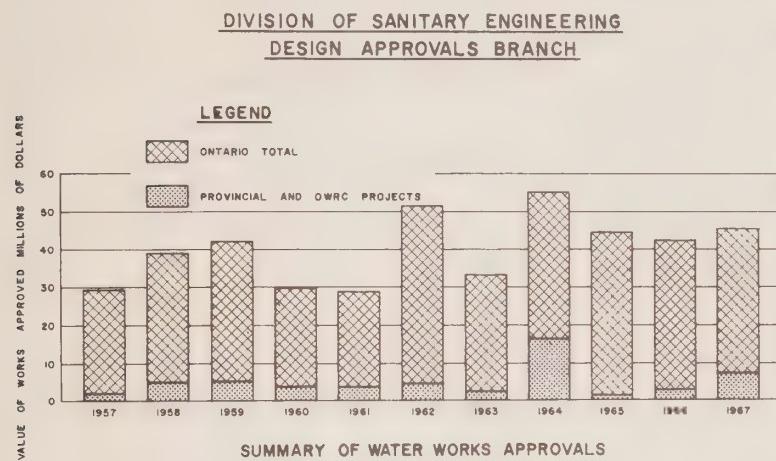
Water Works	Estimated Cost	Sewage Works	Estimated Cost
Extensions to existing systems	\$ 34,631,586.94	Extensions to existing systems	\$108,462,797.94
Supply and purification	9,310,283.85	Treatment and disposal	15,707,044.50
New Systems	<u>1,577,745.00</u>	New Systems	<u>4,740,604.69</u>
Total	\$ 45,519,615.79	Total	\$128,910,447.13

The total number of applications for water works and sewage works approved for the year 1967 was 1,955 and involves a Grand Total estimated expenditure of **\$174,430,062.92**.

PROVINCIAL PROJECTS

Municipality	Water Works	Sewage Works	Total Estimated Expenditure
Beaverton	\$ —	\$ 540,700.00	\$ 540,700.00
Beeton	—	154,420.00	154,420.00
Ear Falls Townsite (Phase I)	268,700.00	294,420.00	563,120.00
Moosonee Townsite (Stages 2 & 3)	479,522.00	744,256.00	1,223,778.00
Lake Erie Water Supply System	5,341,705.00	—	5,341,705.00
Pickering Village	—	1,259,240.00	1,259,240.00
Red Lake Township	776,000.00	487,700.00	1,263,700.00
Woodbridge	—	397,200.00	397,200.00
TOTALS	\$6,865,927.00	\$3,877,936.00	\$10,743,863.00

A summary of the water and sewage works approvals with details of the certificates issued in 1967 follows:



District Engineers Branch

Field work continued to be carried out under the supervision of four district engineers, each of whom covered designated areas in Ontario. In this work, inspections were made in every part of the Province. The routine work involved water pollution surveys, the inspection of refuse disposal sites, feed lots, piggeries and chicken raising plants relative to possible water pollution, and the inspection of water works and sewage treatment plants throughout the Province.

Water Works

There were 2112 routine and special inspections made of water treatment plants by the district staff. This can be compared with a total of 1484 in 1966. A total of 4098 bacterial and 2937 chemical samples was secured during the water works inspections. The number of recorded water works inspection points increased from 1,023 in 1966, to 1035 in 1967, necessitating an increased number of inspections each year. Part of this increase is due to an expansion of the program to provide assessments of a larger number of summer water works. The yearly inspection objective for the program was three visits for the following water works: chlorinated municipal, year-round-private and industrial (including mines) with townsites, with one visit for systems not requiring disinfection, as well as summer-private and industrial (including mines) not having townsites. During 1967, 1890 inspections were made of the routine inspection points. In 1966 there were 1311 inspections made.

Waste-Water Treatment Works

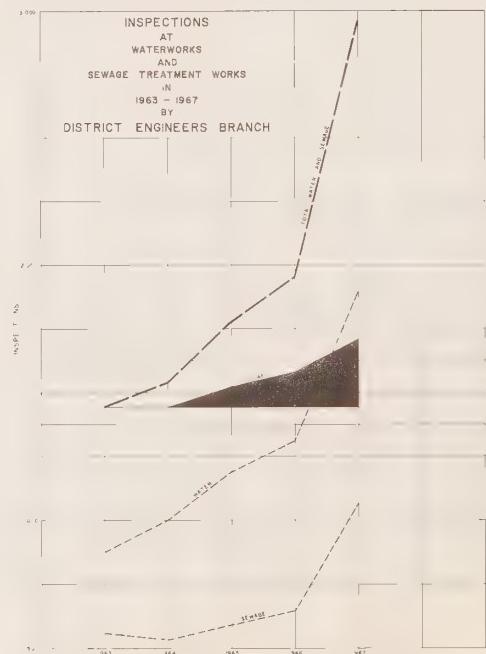
There were 1567 routine and special inspections made during 1967 of waste-water treatment works serving municipalities

and industry. These compare with 1463 inspections made in 1966. A total of 1118 bacterial and 2794 chemical samples was obtained while making these inspections.

The inspection objective for waste-water treatment facilities was three visits a year for secondary municipal sewage treatment plants, one inspection for septic tank facilities with two inspections per year for waste treatment installations serving confined-feeding agricultural installations and primary type municipal sewage treatment plants.

There were 1965 routine inspections of sewage treatment plants and septic tank systems as compared with 645 in 1966. The number of inspection points has steadily increased from 328 in 1962 to 472 points in 1967.

Miscellaneous waste-water treatment facilities serving agricultural installations and sanitary landfill operations were inspected by the staff of the Branch. During the year 140 inspections were made.



Municipal Water Pollution and Water Quality Surveys

As part of the pollution control program field staff performed 183 municipal water pollution surveys. These surveys are designed to locate pollution points and promote the collection and treatment of the offending waste-water discharges. In 1966, there were 58 of these surveys undertaken.

During 1967, there were 42 water quality surveys performed. This type of survey is intended to evaluate the effect of waste-water discharges on the quality of water. During these surveys 2488 bacteriological and 1999 chemical samples were collected.

MISCELLANEOUS

Meetings with Municipal Officials

The staff of the District Engineers Branch continued to have more direct contact with water works and sewage works officials and personnel throughout the Province. During 1967 there were 11 meetings with public utilities commissions and 106 with municipal councils. In addition, discussions were held with various municipal officials. In this connection, there were 694 discussions with municipal clerks, 694 with various other municipal officials, 322 with public utilities commission staff, 153 with health officials and 1122 with other groups or individuals. This is an important aspect of the activities of the Division as it brings about a direct contact between local officials and the Commission in promoting the installation of necessary water and sewage works facilities.

Special Investigations

Special investigations requested by municipalities, the public or senior staff of the Commission constitute a sizeable portion of the work of the Division of Sanitary Engineering. A total of 1034 of these requests was received and acted upon.

Assistance to other Branches

The staff of the Branch continued to assist the Design Approvals Branch in assessments of proposed plans of subdivisions and proposed water and sewage treatment plants.

The Division of Project Development draws heavily on the information and assessments of the Branch with respect to proposed projects.



Construction of Hydrographic and Laboratory Facilities on Survey Vessel "Lac Vancouver"

Water Quality Surveys Branch

The Water Quality Surveys Branch was responsible for planning and implementing water quality control programs and related engineering surveys. Developments in the program during 1967 reflected the announcement by the Commission in June of a strengthening of its water quality objectives policy. This improvement was made possible by increases in scientific knowledge and engineering application of the theories of environmental engineering. Water quality and planning investigations supervised by the Branch dealt with the following aspects:

- (a) waste source and water quality inventories in existing and potential water use areas including the Great Lakes and other drainage basins of Ontario;
- (b) definition of water quality goals taking account of the quality needs of a variety of uses including domestic and industrial water supply; fish, aquatic and wildlife; recreational and agricultural requirements;
- (c) determination of the magnitude and location of acceptable wastewater loadings introduced to lakes or rivers from industries and municipalities; and
- (d) monitoring of water quality and maintenance of remote sensing devices, aerial and launch patrols to detect waste spills, accidents, etc. that might interfere with other rightful uses of water.

Early in the year the Committee on Water Quality Objectives submitted its report on Policy Guidelines for water use in Ontario. Thereafter, the Committee devoted study to the development of a specific statement on water quality control requirements for all waters in Ontario. In keeping with the

policy guidelines, this new approach permits the specification of waste loading limits for wastewater sources discharging to the environment. Where required, provision is made for the eventual development of plans for water use in individual drainage basins of the Province.

With increasing emphasis given to improved water quality control, the River Basins and Great Lakes Surveys programs were reorganized along three distinct lines pertaining to: drainage basin planning, waste treatment proposals evaluation and the water quality surveillance function.

Under drainage basin planning the Great Lakes program was adjusted to obtain information on water quality trends in critical water use areas in the shore waters of the lakes with increased attention being given to work on individual waste sources. In the River Basins program work commenced on intensive basin-wide surveys of the Grand and Ottawa rivers. The latter, a co-operative undertaking with the Quebec Water Board, was started late in 1967 and is expected to continue for a two year period. The project is expected to culminate in the development of waste treatment plans and designs and associated benefits and costs related to the needs of water users on the Ottawa River.

An increased number of municipal and industrial waste treatment proposals were examined during the year for adequacy in protection of receiving waters.

The surveillance of Great Lakes coastal and inland waters was increased using both manual and machine collection of data. Eight aerial patrols of the lakeshore waters were carried out and increased use was made of small boat patrols in surveillance of possible waste spills along the connecting channels of the Great Lakes.

Great Lakes Program

The scope of the work carried out in the Great Lakes program included the following aspects: water use studies and population forecasts, studies of the sources, character and disposition of wastes introduced into the shore waters of the

lakes, water quality problems including nutrient additions, oxygen depletion, build-up of conservative chemicals, bacterial and biological pollution and evaluation of remedial measures.

Progress on the lower lakes inventory in co-operation with the International Joint Commission was sufficiently advanced during the year that attention was gradually shifted to gearing the survey program to the more intensive lake investigations to be carried out under the new water use policy of the OWRC. In addition, special progress reports were prepared on the Niagara River and the Superior-Huron-Erie connecting channels as joint presentations of Ontario and the respective American States to the Advisory Boards of the International Joint Commission.

The program in the lakes and connecting channels was intensified with the use of six vessels on investigations of water quality and wastewater diffusion in heavy water use and harbour areas along the lower lakes and in certain harbours in the upper lakes. The vessels included:

- the 65 foot converted tug Lac Vancouver
- the 80 foot converted tug Atomic
- the 35 foot survey vessel Cato II
- the 30 foot survey launch Pelican
- the 19 foot survey launch Monitor
- the 33 foot survey launch Mallard

Two of the six vessels, the Lac Vancouver and the Atomic, were staffed with additional scientists and operated on a seven-day week continuous basis. The Mallard, a rental vessel, owned by the Great Lakes Institute, was employed in late fall investigations of Lake Erie at the site of the proposed thermal generating station at Nanticoke. Late in the year, the Cato II was made ready for the first winter season operation to be undertaken by the Commission. The vessels were equipped with hydrographic and field laboratory facilities. Maximum use was made of onshore laboratories at London and Toronto in the determination of physical, chemical, bacterio-

logical and biological water quality characteristics. Computer data storage and retrieval systems were employed to facilitate the analysis and interpretation of data gathered from 14,000 station locations in the lakes and connecting channels.

The field work on Lake Ontario extended from May 17 to October 18 and included seven monitor surveys in the coastal waters from the Niagara River to the Bay of Quinte together with detailed studies at Oshawa, Belleville, Picton, Trenton, Cobourg, Port Hope, Hamilton and Toronto. Similar work was carried out on Lake Erie during the period of April 23 to November 15. It included detailed studies at Leamington, Kingsville, Port Burwell, Port Dover, Port Maitland, and Port Stanley.

The surveillance program and detailed waste source investigations on the Detroit-St. Clair river systems extended from April 1 to October 31. The field operations on the Niagara River were extended into the winter and covered the period from May 1 to December 15. Only one cruise was carried out on Lakes Huron and Superior and included two surveys on the lakes and a detailed study of the pulp and paper mill waste pollution at Nipigon Bay.

Seven major oil spills were investigated in the surveillance work on the St. Clair-Detroit rivers, lower Niagara River and lakes Ontario, Erie and Huron. Where the source of the problem was identified, appropriate action was taken to prevent a recurrence.

Growing public interest in the regional water and sewage programs of the Commission increased the demand for water quality information from consulting engineers, industry and the general public in areas where these systems have been proposed. The capacity for exchanging information has been increased substantially with the utilization of electronic data processing.

River Basin Surveys

The initial work on major drainage basin planning projects commenced on the Grand and Ottawa rivers and included preliminary field and aerial reconnaissance of the problem sections of the rivers. Detailed field studies were made on the Grand River basin downstream from Guelph and Brantford, to be extended in 1968 to include other problem sections of the river. Similarly, the Ontario-Quebec Ottawa River project was designed to examine the major factors affecting water quality and use of that river from Lake Timiskaming to near its mouth. Other projects were carried out on Duffin Creek downstream from Stouffville and below pulp and paper mills at Espanola on the Spanish River and Iroquois Falls on the Abitibi River. The latter was an extensive project requiring a helicopter to gain access to 60 miles of the river downstream from the paper mill.

A brief was prepared and presented to the Canadian/Ontario Rideau Study Committee on "Aspects of Pollution in the Rideau River System".

For the purposes of the IJC lakes reference, staff prepared an inventory of municipal and industrial use of the drainage basins tributary to the lower Great Lakes. Waste material introduced to these basins was compared with the quality of each stream at its point of discharge to the lakes. Population forecasts and future use of the basins were also estimated. In addition, two basins, considered typical of mixed rural and urban use, were selected for intensive study to determine the source and influence of nutrient chemicals introduced to the streams from land drainage and municipal discharges. Both Duffin Creek (Lake Ontario) and Catfish Creek (Lake Erie) were examined for quality and streamflow on a weekly basis.

Radiological Program

The second year of the detailed investigations in the Elliot Lake and Bancroft areas to determine the extent of radiological contamination of water from uranium mill tailings

was completed successfully. This work was extended to include the Agnew Lake area and sections of Lake Ontario at the Eldorado waste disposal site at Port Granby.

The "Interim Report on Radiological Water Pollution in the Elliot Lake and Bancroft Areas, 1966" was prepared on the findings of the 1966 program and published during the year.

Waste Treatment Proposals

Eighteen proposals for municipal and industrial waste disposal were reviewed in the latter part of 1967 following adoption in mid-year by the Commission of the policy on water use.

Water Quality Monitoring

The water quality monitoring program designed to provide quality data on monthly seasonal and annual variations at selected sampling stations throughout the Province was expanded to 375 locations. As in the past, 13 conservation authorities and one health unit assisted in the collection of data. All stream locations on the water quality monitoring program were coded and the data collected since 1964 transferred to electronic data processing during the year. The publication "Water Quality Data - 1964-65" was released and widely distributed.

The Commission's first robot monitoring station was set up to continuously sample and analyse St. Clair River water downstream from the Sarnia industrial area. Located at the Corunna sewage treatment plant, the unit measured and recorded data on dissolved oxygen, temperature, conductivity, pH and chlorides.

Plumbing and Boating Branch

Plumbing

In the Province of Ontario the installation, maintenance and repair of plumbing, with a few minor exceptions, is controlled by the Provincial Plumbing Regulation. It is the responsibility of this Branch to maintain an up-to-date regulation and provide technical liaison with municipal inspectors. The Branch is assisted in its function of maintaining a modern code by the Plumbing Advisory Committee made up of representatives from industry, municipal regulatory authorities and design consulting engineering firms.

The current trend to prefabricated housing is creating an inspection problem. The plumbing for this type of housing is constructed and installed in one municipality and placed into service in another. This is increasing the pressures already existing in some areas to have plumbing inspection done by the Province rather than by the municipality.

To maintain any effective control over the quality of plumbing materials at the manufacturing level, something more than field inspection is required and it seems likely that the mandatory compliance with Canadian Standards Association standards, as is already required for plastic pipe and fittings, will be further extended to include other plumbing materials for which such C.S.A. standards exist.

Watercraft Pollution Control

The Boating Regulation was first introduced in 1966. As the Regulation will affect in one way or another every boat owner directly, a preliminary development and information program was commenced during 1967.

The Regulation makes marine heads and allied equipment subject to OWRC approval. The answering of enquiries and

the processing of applications and approvals for this equipment occupied a large portion of the 1967 work load. To provide for the disposal of wastewaters collected by holding tanks installed on boats, a questionnaire was forwarded to all marinas in the Province. As a result visits were made to marina operators showing an interest in installing pump-out facilities.

In addition, a number of requests were received to speak at Yacht Clubs, marine dealers organizations and other groups concerned about the Regulation.

With the Regulation going into effect on January 1, 1969, additional staff will be retained to advance the watercraft pollution control program.

Regional Services Planning Branch

The Branch continued to study and report on the provision of water supply and pollution control facilities on a regional or watershed(s) basis in developing areas throughout the Province in accordance with stated government policy. Assistance of the divisions of Industrial Wastes, Laboratories and Water Resources together with other branches of this Division is obtained in order to provide a complete picture of the problems and to produce the most reasonable scheme(s) based on engineering, economic and other general considerations.

Assistance was provided in reviewing area water supply and pollution control schemes proposed by Consulting Engineers. Included in this were both conceptual and detailed reviews of the proposal when received.

The County of Elgin - Southern Area Regional Pollution Control Study was completed, printed and distributed on June 16, 1967. This report had been requested by the area municipalities.

The Southern Ontario County and Region - Water Supply and Pollution Control Study is well underway. It is anticipated that the report will be completed early in 1968. Other reports underway include the Lakehead Area - Regional Water Supply and Pollution Control Study and the Grand River Watershed - Pollution Control Study.

A paper on the Commission's role in regional planning was prepared and presented at "A Short Course on Regional and Transportation Planning" at Queens University in Kingston. In addition, the Branch actively participated on the Technical Advisory and Co-ordinating Committee of the Metropolitan Toronto and Region Transportation Study (MTARTS) as the OWRC representative.

A long-range program for future studies is being planned and its implementation will be dependent upon the requirements of developing areas in the Province.

Water and Sewage Works Operators' Courses

Basic and Intermediate courses for water works operators were held during the year with attendance of 109 and 89 operators, respectively.

There were two courses of instruction for sewage works operators with 120 operators attending the Intermediate Course and 114 operators attending the Senior Course and obtaining certificates of qualification.

Since the inception of the training courses for water and sewage works operators, certificates of qualification have been granted to 411 sewage works operators and 266 water works operators.



DIVISION OF WATER RESOURCES

K.E. SYMONS Director D.N. JEFFS Assistant Director

Established programs concerned with water-resources surveys, test-drilling and well-construction projects, water management, well-construction management, and hydrologic studies and data collection were carried forward by the four branches of the Division of Water Resources. Hydrogeologic surveys and test drilling projects remained at a high level, the number reflecting activities for provincially-owned water systems.

The work of the Division is set out under broad divisional and specific branch activities.

DIVISIONAL ACTIVITIES

Cartography

The cartographic section supported all programs of the Division by preparing maps, charts and diagrams and by procuring maps, plans, aerial photographs and mosaics from various sources.

Two multicolour maps were printed for the Big Otter Creek Survey and four completed for printing. Forty-four monochrome maps were completed and reproduced, including a preliminary base map of the Albany River drainage basin.

ARDA Projects

The report, Synoptic Water Resources Survey in Southern Ontario 1964-1965, was completed and released. The reports of the water resources surveys for the drainage basins of Big Creek and Big Otter Creek were being prepared. These three surveys had previously been approved for support under the Agricultural Rehabilitation and Development Act.

International Hydrological Decade Program

Progress continued with two of the three approved International Hydrological Decade projects. These were Representative River Basin Studies and Assessment of Ground Water.

Emphasis was continued on the instrumentation and basic data collection in the five representative basins by the River Basin Research Branch. Maps showing completed instrumentation in these basins were prepared and submitted to the IHD National Committee. A preliminary data report entitled "Snow Survey Report - Wilmot Creek Basin, 1966-1967", was prepared and distributed. This was the first report released regarding IHD studies being undertaken by the OWRC.

As part of the Hydrologic Data Branch's program of ground-water assessment a paper entitled "Aquifer Test in a Sand Plain at Bothwell, Ontario" was prepared, and a second paper entitled "Aquifer Test in a Sand Plain near Harrow, Ontario" was in the process of preparation. These special ground-water aquifer testing studies were continued in the Guelph and Lockport bedrock formations in the County of Grey.

Members of the Division participated in the work of the Ontario Committee for the International Hydrological Decade and its scientific and educational subcommittees and in the Workshop Seminar on Groundwater - Streamflow Systems in Quebec City and in the Familiarization Seminar on the Principles of Hydrology at the University of Guelph.

A member of the Division accepted an invitation to serve on the Working Group on the Terrestrial Water Balance, a committee set up to determine the program for the proposed International Field Year on the Great Lakes, 1970/71.

Northern Ontario Water Resources Studies

The studies of the water resources of northern Ontario were continued. A report on a survey in the Attawapiskat River basin was received from a consulting firm retained to carry out the work. Field work was carried out by the Division for a survey in the Upper Albany River basin. General hydrologic investigations were carried out through the entire region. Close co-operation was maintained with the Federal Department of Transport and the Department of Energy, Mines and Resources with respect to the development of hydrometric networks. The Division participated in the work of the Federal-Provincial Co-ordinating Committee on Northern Ontario Water Resources Studies which met twice during the year to review and ensure co-ordination of the work being carried out by the various federal and provincial agencies.

Electronic Data Processing

With the planned installation of an electronic data processing system by the Commission, the interests of the Division were represented by divisional members serving on the EDP committees on Laboratory Analyses and Coding Systems. One representative of the Division, who completed a course of training in the application and development of systems and programs for divisional use, was active in the development of the OWRC Landing Coding System, a proposed new Water-Well Record System, a proposed new Water-Taking Permit System and a Watershed Coding System. The QUIKTRAN terminal of the Systems and EDP Branch was used in support of projects carried out by the River Basin Research Branch and the Surveys and Projects Branch of the Division.

Educational Activities

The Division actively supported training and continued education of its staff members. The year featured outstanding opportunities for reviewing recent developments in hydrology.

The Division helped staff four booths at exhibitions. Its members presented lectures, talks and papers to a variety of groups.

Surveys and Projects Branch

The Branch was active in water resources surveys including drainage basin surveys, regional studies and municipal hydrogeologic surveys and water-supply projects including test drilling and well construction in connection with the exploration and development of ground water supplies for municipal purposes. Special investigations included studies of water-supply problems, ground-water pollution and hydrogeology of landfill disposal sites.

Work progressed on two drainage basin surveys in Southern Ontario and was extended into a second basin in Northern Ontario. Four regional studies, 20 municipal hydrogeologic surveys, 13 test-drilling or well-construction projects and 56 special investigations were completed or in progress. Tables 1 and 2 and Figure 1 present a summary of these activities.

Drainage Basin Surveys

The preparation of reports on water-resources surveys of the Big Creek and Big Otter Creek drainage basins initiated in previous years progressed slowly because of the commitment of personnel to other duties.

A survey was initiated of the water resources of the Albany River basin in Northern Ontario. Field work was completed on the upper section of the basin and a report was in progress. The report of the consultants on the Attawapiskat River basin was received.

Regional Studies

Assessments of the availability of regional water resources

were completed or in progress for four regions in the Province: the County of Ontario - Southern Area, the County of Elgin - Southern Area, the Lakehead Area, and the Grand River Watershed. The assessments were prepared in support of studies of water supply requirements carried out jointly with other divisions of the Commission.

Municipal Hydrogeologic Surveys

Surveys to evaluate local ground-water conditions for municipal water supply purposes were carried forward for nine municipalities and initiated for 11. Fourteen reports containing recommendations regarding the exploration and development of the resource were completed. Surveys were continued for the cities of Galt and Guelph, the Town of Latchford, the villages of Alfred and Drayton and the communities of Fauquier, Keswick, Mileage 104 and Vermilion Bay. Surveys were initiated at the City of Woodstock; the towns of Alliston, Bruce Mines, Ridgetown and Thornbury; the villages of Millbrook, Stouffville and Sundridge; the community of Rockwood and the townships of Markham and Kingston (Aylesworth Subdivision).

Test Drilling and Well Construction Projects

Test-drilling projects located adequate water supplies for the Town of Drayton, the Village of Port Perry, the community of Rockwood, and the Blezard Valley Region. Municipal wells were constructed at Drayton, Port Perry, Rockwood and the Police Village of Orleans. In all, the Branch carried forward or initiated work on 10 test-drilling projects and three well-construction projects. Reports were being prepared for test-drilling projects carried out during the previous year at the communities of Callander, Haliburton and Plattsville. At the end of the year preparations were being made for test-drilling projects at the Town of Bruce Mines and the villages of Alvinston and Millbrook, and for a well-construction project at the community of Minden.

Special Investigations

Fifty-six special investigations or studies into ground-water pollution, water-supply problems and the effects of landfill disposal of sanitary and industrial wastes on ground water were completed or initiated. Two investigations were carried forward from the previous year. Twenty-five required field inspections; 8 were in progress at the end of the year.

Twenty-one of the investigations dealt with ground-water pollution, 22 with water-supply problems and 13 with the effects of waste disposal on local ground water. Six investigations were made on behalf of the Ontario Department of Highways. Two of these dealt with pollution problems due to road salt and two dealt with the evaluation of the probable effects on local ground-water resources of proposed salt and sand stock piles.



Streamflow Measurement Party on Northern River

DIVISION OF WATER RESOURCES
SURVEYS AND PROJECTS BRANCH

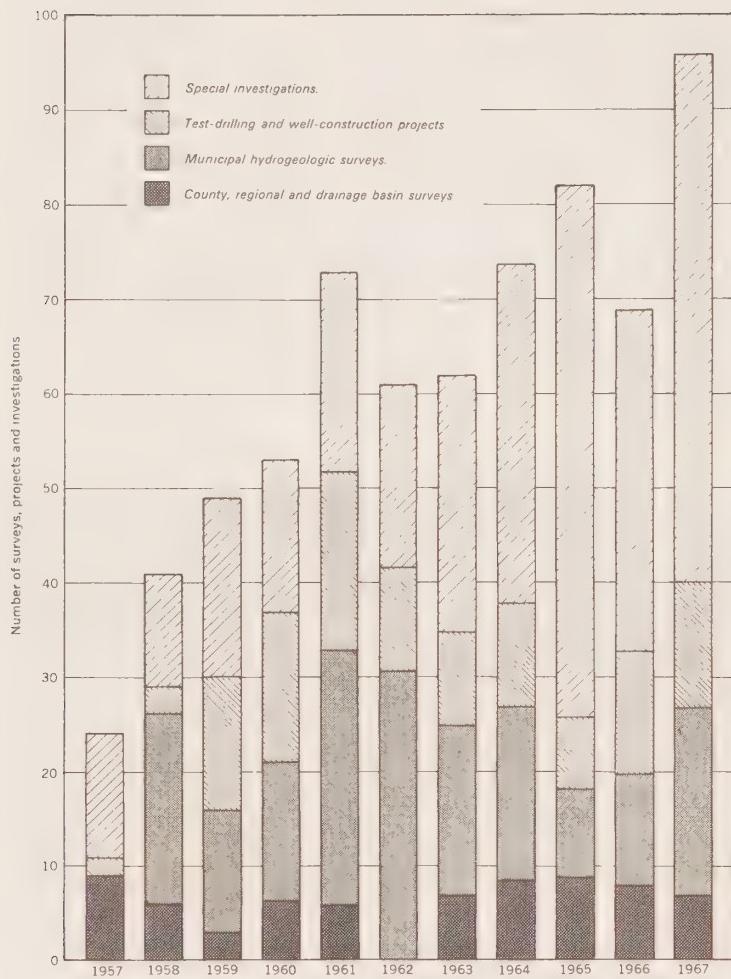


FIGURE 1. ACTIVE AND COMPLETED SURVEYS
PROJECTS AND INVESTIGATIONS

Table 1 - Summary of Survey Activities - 1967

Activity	Location	Type of Activity	Report
		Field	Office
Drainage Basin Surveys	Big Creek		x
	Big Otter Creek		x
	Upper Albany River	x	x
	Attawapiskat River (by contract)		x
Regional Studies	County of Ontario		
	Southern Area		x
	County of Elgin		
	Southern Area		x
	Lakehead Area	x	x
Municipal Hydrogeologic Surveys	Grand River	x	x
	Alfred	x	x
	Alliston	x	x
	Bruce Mines*	x	x
	Drayton*		x
	Fauquier*		
	Galt-Preston-Hespeler		x
	Guelph		x
	Keswick		x
	Kingston Township (Aylesworth subdivision)	x	x
	Latchford*		x
	Markham Township	x	x
	Mileage 104		x
	Millbrook*	x	x
	Ridgetown	x	x
	Rockwood*	x	x
	Stouffville	x	x
	Sundridge*	x	
	Thornbury*	x	x
	Vermilion Bay*		x
	Woodstock	x	x

*For Proposed Provincially-Owned System

Table 2 - Summary of Project Activities – 1967

TYPE AND LOCATION	CONTRACT STATUS AT DECEMBER 31, 1967		REPORT COMPLETED	WELLS COMPLETED	COMPLETED Production
	Preparation	Active			
<i>Test Drilling</i>					
Callander*	x			11	1
Drayton*	x			1	1
Haliburton*	x			13	
Plattsburgh*	x			4	1
Port Perry	x		x	9	
Blezzard Valley*	x		x	19	
Rockwood*	x		x	2	2
Alvinston*	x		x		
Bruce Mines*	x		x		
Milbrook*	x		x		
<i>Well Construction</i>					
Port Perry		x		1	
Orleans		x		19	
Minden	x				

* For Proposed Provincially-Owned System



A current measuring device, similar to those used to measure wind velocity, is lowered through one of 20 holes drilled across the ice-covered Albany River by an Ontario Water Resources Commission team, with the aid of a gasoline-powered ice auger (foreground). Members of the OWRC's Division of Water Resources, they are engaged in a long-range inventory of Ontario's northern waters.

Water and Well Management Branch

The activities of the Water and Well Management Branch were carried out under two distinct programs: water management and well-construction management.

The main activities under the water management program included processing of applications and permits for the taking of water, investigating complaints concerning reported interference with water supplies and enforcing legislative and permit requirements. Under the well-construction management program, activities mainly concerned checking the location of new wells and their sanitary construction, investigating complaints against water-well contractors and possible infractions of statutes, and compiling information for formulation of well-construction regulations. Figure 2 shows the surface-water and ground-water investigations carried out since 1961 and the well-construction investigations since 1965.

WATER MANAGEMENT PROGRAM

Applications and Permits

Table 3 shows a summary of water permit data for 1967.

Of the 525 permits issued, 375 were for irrigation, 38 were for municipal-supply purposes, 55 were for industrial purposes, 5 were for commercial purposes and 52 were for recreational purposes. A total of 335 permits were cancelled, most because of a change in ownership of properties, and 168 amendments were authorized by the Commission.

Table 4 shows the number of permits issued and the amount of takings authorized for 1967, according to drainage basin, source and purpose. Table 5 is a summary of amounts of water taking approved by permit for various purposes since 1961. Figure 3 shows graphically the amounts and purposes of authorized surface-water and ground-water takings since 1961.

Water Management Investigations

Seventy-four ground-water and surface-water interference problems were investigated during the year. The number of ground-water investigations was slightly lower in 1967 than in 1966 and the number of surface-water investigations decreased considerably, probably due to the generally wet spring and summer conditions.

Ground-Water Interference Investigations

Forty-seven investigations of ground-water interference problems were carried out and reports were completed for 24 of the problems during the year. Most of the investigations required repeated field trips to assemble sufficient data to resolve causes and responsibilities clearly.

The municipalities in which investigations were carried out are indicated below. The figures in brackets indicate the number of separate complaints where more than one was investigated.

Townships: Ancaster (2), Brooke, Chinguacousy (8), Colchester South, Darlington (2), Dumfries South, Esquesing, Front of Leeds and Grenville, Gloucester, Goulbourn, Gwillimbury West, Humberstone, Mariposa, Markham, Marter, North Oxford, Oliver, Otonabee, Pelham, Saltfleet, Thorold, Tiny, Toronto, Townsend, Vaughan, West Flamborough, Whitchurch, Wilmot and Yarmouth;

Village: Ayr;

Improvement

District: Beardmore;

Towns: Burlington, Dresden, Oakville, Preston and St. Mary's.

Cities: Galt and Niagara Falls.

Complex well-interference studies requiring numerous field inspections were undertaken in the townships of Chinguacousy, Colchester South, Goulbourn and Westminster.

Township of Chinguacousy – The investigation of complaints of well interference allegedly due to the operation of the Township of Chinguacousy Municipal Well No. 5 continued in 1967. In no instance was the interference alleged in new complaints deemed to be a responsibility of the Municipality.

Township of Colchester South – Considerable time was spent in the vicinity of the settlement of Oxley obtaining data on ground-water conditions prior to and during the test pumping of a privately-owned irrigation well. This information will be used to assess complaints of interference with private well-water supplies allegedly due to the operation of the irrigation well.

Townships of Goulbourn and March – Information was collected on ground-water conditions in the vicinity of the Glen Cairn and Kanata subdivisions before and after the Glen Cairn and Kanata municipal wells were placed in operation. The information will be used in assessing a number of complaints of well interference submitted by local residents.

Township of Westminster – Regular monthly measurements of water-levels in a number of private wells in the vicinity of the London-White Oak municipal well field was continued until the Lake Huron Water Supply System was placed in operation.

Surface-Water Interference Investigations

Twenty-seven investigations of complaints concerning interference with surface-water supplies or depletion of streamflow were made, and reports were completed for all of the investigations.

The municipalities where investigations were carried out are indicated below. The figures in brackets indicate the number of investigations in municipalities where more than one problem occurred.

Townships: Adelaide, Albion, Ancaster (2), Brighton, Chinguacousy, Delaware, Eramosa (2), Erin, Gwillimbury East (2), Hillier, Malahide, Middleton, Mono, North Dumfries, North Gower, Puslinch (2), Reach, Saltfleet, Toronto, Vaughan (2) and Whitchurch;

Town: Oakville

Water Taking Investigations

During the year, 420 farms were visited by members of staff. The water-taking practices of 27 permit holders were checked and 110 applications for permits were obtained. In addition, 240 farm owners were visited specifically to obtain data required to process applications, to check on locations and sources. Irrigation was not practiced on 43 of the farms.

In conjunction with the Hydrologic Data Branch, staff gauges were installed to aid in the assessment of streamflows in the following streams:

Clear Creek, Hay Creek, Fishers Creek, Hemlock Creek, and an unnamed tributary which flows through Forestville to Lake Erie.

Two automatic streamflow gauging stations were installed on a temporary basis on a tributary of Nanticoke Creek near Waterford and on Middle Oakville Creek.

WELL CONSTRUCTION MANAGEMENT PROGRAM

Well Contractors

Four hundred and thirty-six licences were issued in 1967 for carrying on the business of boring or drilling wells for water. Twenty-three licences were held by boring contractors and 413 licences were held by drilling contractors. One licence application was rejected because of the applicant's lack of experience. Records for 9,601 water wells were received during 1967. The number of records received annually for the years 1952 to 1967, inclusive, is shown in Figure 4. The four

inspectors visited water-well contractors on 1,153 occasions and made 10,622 checks on the locations of wells and 583 checks for sanitary well construction.

Meetings with representatives of the Canadian Water Well Contractors Association concerning proposed changes to legislating relating to the well-construction industry were continued during 1967. A meeting was also held with boring contractors to discuss the proposed changes in the legislation relating to bored wells.

A conviction was obtained against a licensed well contractor in the County of Victoria for failing to seal a well casing in a manner sufficient to prevent contamination of the well. A well contractor in the County of Peel was convicted for carrying on the business of drilling wells without a licence. A conviction was obtained against a licensed well contractor in the County of York for failing to make a return to the Commission within one month after completion of a well.

Investigations Concerning Well Regulations

Fifty-eight investigations concerning well regulations were carried out during the year and reports were completed for 50 of these.

The municipalities where investigations were carried out and the number of investigations in municipalities where more than one problem occurred are listed below:

Townships: Adjala, Albion, Ashfield (2), Barrie, Caledon, Charlotteville (2), Chinguacousy (2) Clinton (3), Downie, Esquesing, Euphrasia, Georgina, Gwillimbury North, Haldimand, Harvey, Hope, Huntingdon, Humberstone, Ingram, Kincardine, Keppel (2), Louth, Maidstone (4), Malahide, Mariposa, Mersea, Nassagaweya, North Fredericksburg (2), Orford, Otonabee, Pickering, Portland (2), Reach, Sandwich South, Sidney, Southwold, Toronto Gore, Townsend, Verulam, Westminster, Whitby, Wilmot and Windham;

Villages: Ayr and Markdale;

Town: Oakville;

City: Peterborough.

DIVISION OF WATER RESOURCES
WATER AND WELL MANAGEMENT BRANCH

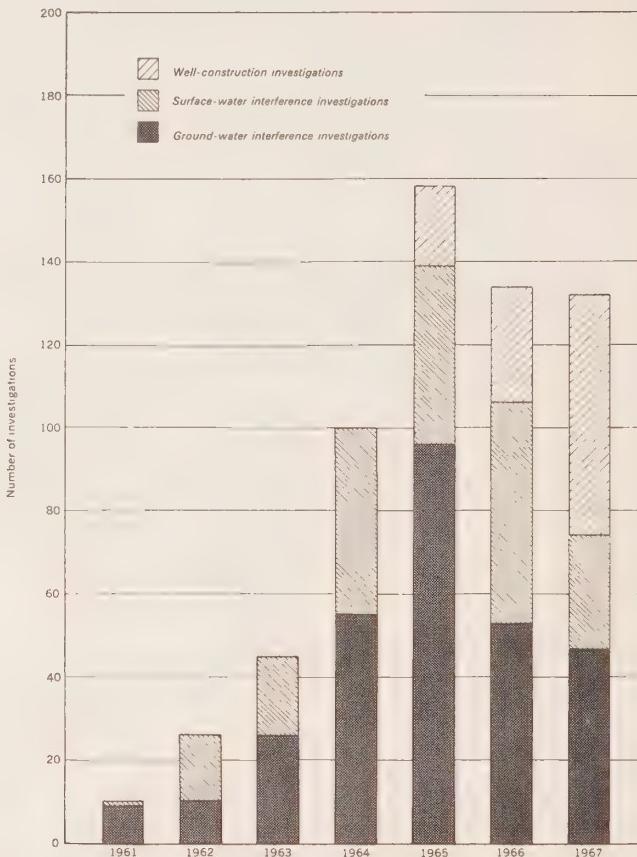


FIGURE 2. TYPES OF INVESTIGATIONS

Note. Well-construction investigations prior to 1965 were not recorded statistically.

TABLE 3 - SUMMARY OF WATER PERMIT DATA FOR 1967

S O U R C E	A P P L I C A T I O N S						Amount of Water Taking Approved by Permit* (MGD)
	Carried Forward From 1966	Received in 1967	Refused Withdrawn or not Required	A P P R O V E D		Under Consideration on December 31, 1967	
				By Letter	By Permit		
Ground Water	36	88	11	13	66	34	22.08
Surface Water	82	490	61	2	445	63	2,331.79
Ground and Surface Water	4	16	—	—	14	6	4.48
	122	594	72	15	525	103	2,358.35

*Does not include water takings approved by letter of approval or by permits where conditions of taking rather than amounts were specified.

TABLE 4-PERMITS ISSUED AND TAKINGS AUTHORIZED IN 1967 ACCORDING TO DRAINAGE BASIN, SOURCE & PURPOSE

DRAINAGE BASIN	SURFACE WATER					GROUND WATER					COMBINED TAKING					TOTALS
	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	
St. Lawrence River			1 .54		1 .04	2 .14	1 .07									5 .79
Ottawa River		2 7.49	7 .81		2 S. C.		3 .26		2 .81							16 9.37
Lake Ontario	1 .29	11 1,309.40	52 12.17	4 .43	21 .33	1 .04	2 .48		8 2.85	1 .07		1 .16		1 .04	103 1,326.26	
Lake Erie & Lake St. Clair		13 873.51	270 71.55	2 .87	9 .15		6 1.06	11 2.55	11 8.18	2 .08		8 3.62				332 961.57
Lake Huron		5 7.15	21 4.72	1 .16	13 3.60	1 .01	2 .85	1 .18	9 4.36			3 .16				56 21.19
Lake Superior		4 28.39			2 S. C.		2 .08									8 28.47
Hudson Bay		3 10.19					1 .01						1 .50			5 10.70
Totals	1 .29	38 2,236.13	351 89.79	7 1.46	48 4.12	4 .19	17 2.81	12 2.73	30 16.20	3 .15		12 3.94	1 .50	1 .04		
GRAND TOTALS			445 2,331.79				66 22.08					14 4.48				525 2,358.35

NOTES: (i) In each square the number of permits issued appears above with the amount of authorized water takings in IMGD.

(ii) S.C. - Permits are issued under special conditions; no rates or amounts of water takings are specified.

(iii) Purposes - COMM. - Commercial; IND. - Industrial; IRR. - Irrigation; MUN. - Municipal; REC. - Recreational

**TABLE 5 – SUMMARY OF AMOUNTS OF TAKING
APPROVED BY PERMIT FOR VARIOUS PURPOSES**

PURPOSE	1961 MGD	1962 MGD	1963 MGD	1964 MGD	1965 MGD	1966 MGD	1967 MGD
Commercial	0.28	3.88	0.36	1.48	1.36	1.45	.48
Industrial	10.34	10.45	26.38	329.14	947.91	1310.08	2238.94
Irrigation	0.38	8.88	774.09	51.49	134.82	94.23	96.46
Municipal	6.53	12.13	21.24	103.62	31.49	17.69	18.16
Recreation	—	—	0.93	0.23	0.05	0.07	4.31
TOTALS	17.53	35.34	823.00	485.96	1115.63	1423.52	2358.35

NOTE: The amounts do not include water takings approved by letters of approval or by permits where conditions of taking rather than amounts were specified.

DIVISION OF WATER RESOURCES
WATER AND WELL MANAGEMENT BRANCH



FIGURE 3. AMOUNT OF WATER TAKING AUTHORIZED BY PERMIT ACCORDING TO YEAR AND SOURCE

DIVISION OF WATER RESOURCES
WATER AND WELL MANAGEMENT BRANCH

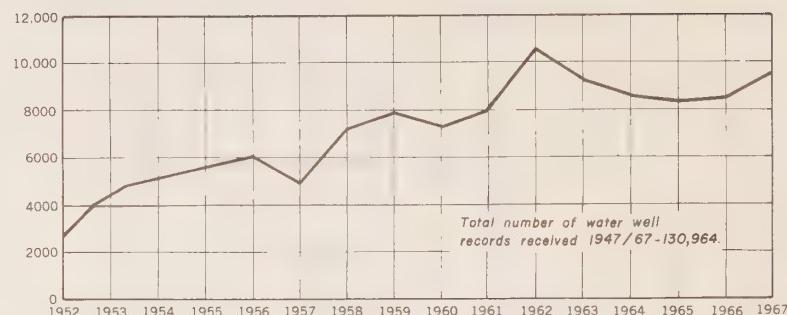


FIGURE 4. NUMBER OF WATER WELL RECORDS RECEIVED ANNUALLY

Hydrologic Data Branch

The Hydrologic Data Branch continued the collection, analysis and distribution of hydrologic Data. Basic networks for the measurement of streamflow and groundwater levels were expanded and maintained and hydrometric measurements made for a number of specific programs. The Branch served the public and internal programs by supplying information on streamflow, ground-water levels and aquifer conditions.

Observation Wells

At the end of the year, 130 observation wells were in operation from which water level data were received and plotted on a regular basis. Twenty-two new observation wells were established and readings from two wells were discontinued. Most of the new wells were established in areas for which little information had been available on the fluctuations of

ground-water levels. Figure 5 shows the number of observation wells in operation at the end of each year since 1957. All observers in the program were volunteers and their valuable public service is gratefully acknowledged.

Hydrogeologic Data

Water-well records submitted by licensed water-well boring and drilling contractors were filed by the Branch for internal and public use. A total of 9601 water-well records was received during the year. Hydrogeologic data from the well records and from the observation wells are published in the form of ground water bulletins. During the year, Ground Water Bulletin No. 5, Ground Water in Ontario, 1959, was published. Printing of Ground Water Bulletin No. 6, Ground Water in Southwestern Ontario, 1960-1963, was virtually complete at the end of the year; a substantial amount of typing of the material for Ground Water Bulletin No. 7 for the South-Central Area of Ontario for the years 1960-1964 was completed and typing of material for Ground Water Bulletins Nos. 8 and 9 for the Eastern and Northern Areas of Ontario, respectively, was in progress.

Public Enquiries

The demand for hydrogeological information increased substantially during the year and 324 summaries of ground-water conditions were prepared in response to public enquiries. A total of 216 written replies was sent out as well as 98 letters enclosing 3514 copies of well records. Much information was made available verbally through 682 telephone calls. One hundred and ten visits were made to the office by persons who consulted the records or discussed ground-water conditions or problems.

Surface-Water Hydrometric Installations

Streamflow data were assembled by the Branch through the operation of streamflow gauging stations and a co-operative program with the Inland Waters Branch, Canada Department of

Energy, Mines and Resources, for the installation and maintenance of stations. The number of permanent gauging stations operated or supported by the Branch increased from 88 to 131 during the year. Table 6 summarizes the number and types of streamflow gauging stations supported by the Branch as well as those operated by other branches of the Division.

Table 6 - Summary of Types of Streamflow Gauging Stations by Operating Agency

OPERATING AGENCY	NUMBER OF GAUGING STATIONS		
	Recording	Manual	Total
Inland Waters Branch - supported by the Division of Water Resources*	57	1	58
Hydrologic Data Branch	8	65	73
River Basin Research Branch	15	5	20

*Note: The Inland Waters Branch operated or published data for an additional 243 streamflow gauging stations in Ontario of which 148 were equipped with recorders, 48 had manual devices and 47 comprised power plants or combinations of several stations. Fifty-six other hydrometric stations were operated to measure water levels only including one supported by the Division in Northern Ontario.

Of the 73 streamflow gauging stations operated by the Branch, 36 were in support of the water quality monitoring program; 22 for the radiological pollution investigation program; 6 for the drainage basin survey program; 5 for the water management program and 4 for special short term studies. Of the 58 gauging stations co-operatively operated with the federal agency, 24 were for the Northern Ontario Water Resources Studies. Figure 6 shows the type and number of permanent streamflow stations in operation since 1963.

Synoptic Survey

The report, Synoptic Water Resources Survey in Southern Ontario 1964-1965, was published. Streamflow measurements, ground-water observations and precipitation measurements were made during the year in the basins of the following rivers: Holland, Coldwater, Ganaraska and South Nation. A draft report for the studies continued during the years 1965 to 1967 was prepared and under review.

International Hydrological Decade

The assessment of ground-water conditions, an accepted International Hydrological Decade project, was continued. A drilling and test pumping project to determine the hydrogeologic characteristics of the Guelph and Lockport formations was under way in the Township of Sullivan, in the County of Grey. Field and office studies to determine the vertical and horizontal permeabilities of the shallow sand aquifer at Bothwell were completed.

A paper entitled "Aquifer Test in a Sand Plain at Bothwell, Ontario," was prepared for publication in volume 19 of the Geological Association of Canada Proceedings. A report "Aquifer Test in the Township of Colchester South near the Town of Harrow" was under preparation.

Northern Ontario Water Resources Studies

The collection of hydrological and geological data in Northern Ontario drainage basins was continued. Twelve sites were investigated and the streams at these sections were gauged with two repeat measurements at each site. Three of the twelve sites are considered suitable for permanent installation. Geological observations were made at each site by the digging of pits and the examination of the pleistocene deposits. The dominant rock types and vegetation were also noted. Physical and chemical analysis of water samples were made in the field. Mississa Lake was echo-sounded and the surrounding geology was investigated. One observation well

was established in the Otoskwin River basin near Badesdawa Lake and will record the fluctuations of ground water in a sand and gravel layer above the bedrock formation at a depth of about 80 feet below ground level.

A pleistocene geology map of the Severn, Winisk and part of the Albany basin was under preparation.

Twenty-four streamflow gauging stations were operated co-operatively with the Federal Government. The installation of recorders has been delayed at two of the above stations.

Radiological Pollution Investigation

In the Elliot Lake area two of the 16 streamflow gauging stations were converted from manual to recording operation and rating curves were developed for 11 of these. One wooden walkway was constructed for metering high flows at one site. In the Bancroft area one recording station was installed by the federal agency and rating curves were developed for three of the six manual stations operated by the Branch. Difficulties with access to stations and measuring sections prevented development of rating curves at some stations.

DIVISION OF WATER RESOURCES
HYDROLOGIC DATA BRANCH

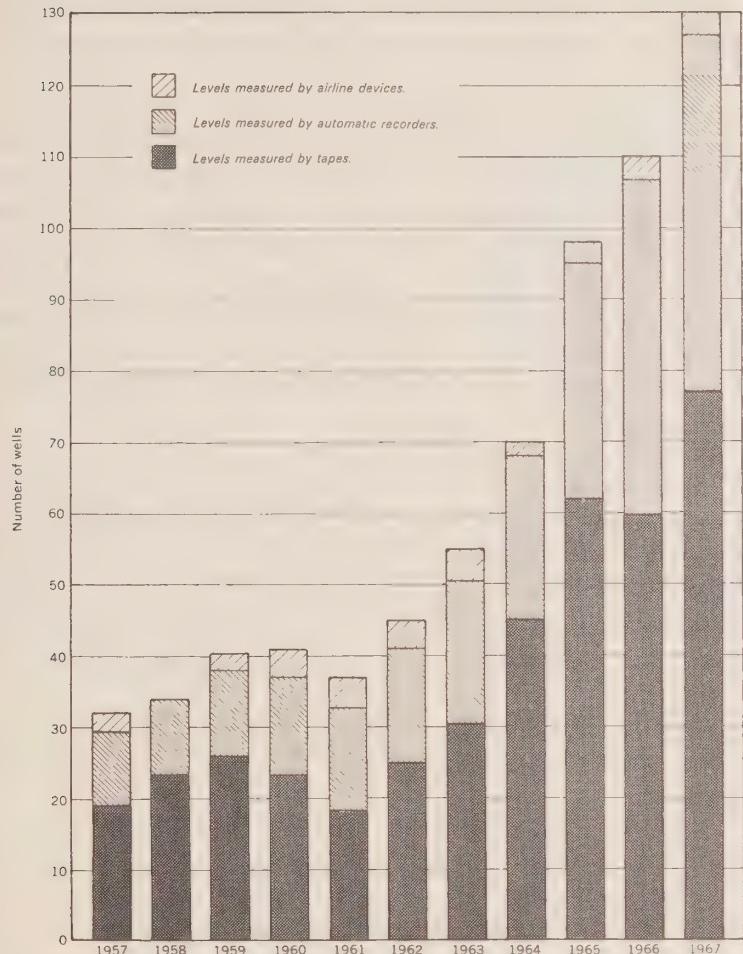


FIGURE 5. OBSERVATION WELLS IN OPERATION

DIVISION OF WATER RESOURCES
WATER AND WELL MANAGEMENT BRANCH

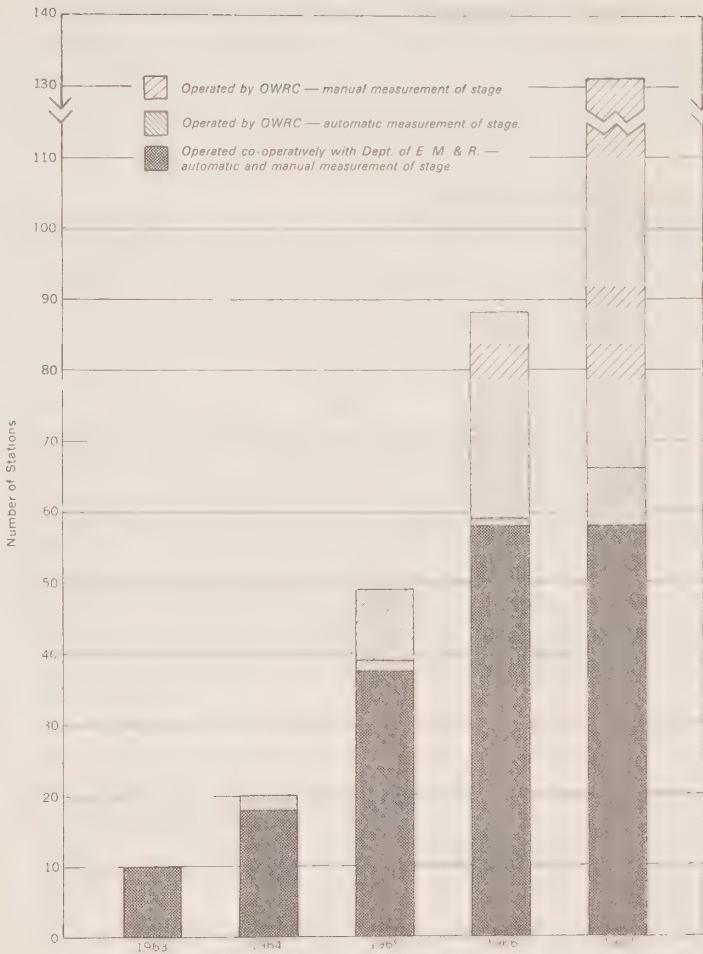


FIGURE 6. STREAMFLOW GAUGING STATIONS OPERATED BY THE BRANCH OR MAINTAINED CO-OPERATIVELY WITH THE FEDERAL GOVERNMENT

River Basin Research Branch

The activities of the River Basin Research Branch included much of the work undertaken in the Commission as part of the International Hydrological Decade as well as specialized studies such as sieve analyses, electric well logging and geophysical surveys, many of which were in support of the programs of other branches of the Division.

Representative Basin Studies

The study of hydrologic conditions in five drainage basins representative of major geomorphic regions in southern Ontario continued as an International Hydrological Decade project.

One automatic streamflow gauging station and three staff gauges were installed in the basins. Three hundred and seventy-nine flow measurements were taken at 24 stations. Seven observation wells were installed in one of the basins. In co-operation with Meteorological Branch, Department of Transport, five main and 21 satellite climatological stations and two precipitation storage gauges were installed, thus completing the climatological networks in the representative basins. Table 7 shows a summary of the hydrometric stations operated by the Branch in representative basins.

Blue Springs Creek

Studies in the Blue Springs Creek are being carried out in co-operation with the University of Guelph. A joint field trip was held with members of the Branch and representatives of the University to familiarize all parties with instrumentation in the basin.

Routine streamflow measurements were initiated at selected sites in the basin and eight sets of measurements were undertaken at five stations. Six sets of water samples for chemical analyses were taken in conjunction with the streamflow measurements. The University of Guelph commenced a

bi-monthly water quality sampling program at one automatic streamflow gauging station. The samples were analysed by the OWRC Laboratory. Two staff gauges were installed to aid in the establishment of rating curves at two metering sites.

General maintenance work was carried out and data collected from the 16 observation wells previously installed in the basin. Elevations of seven of the wells were determined by precise levelling from established geodetic bench marks.

A seismic geophysical study was initiated to determine the depths to bedrock in certain areas of the basin and to aid in the tracing of buried bedrock valleys. Reconnaissance geologic mapping was carried out and a bedrock contour map was prepared using available water-well records.

Bowmanville, Soper & Wilmot Creeks

One automatic streamflow gauging station and one staff gauge were installed and four artificial controls were constructed in the basin. Seventeen sets of streamflow measurements were undertaken at 12 gauging stations to establish rating curves. Eight sets of water samples for chemical analyses were taken in conjunction with the streamflow measurements.

General maintenance work was carried out and data collected from the 21 observation wells previously installed in the basin.

Reconnaissance geologic mapping was completed in the basin. A detailed piezometric map using the data available from bedrock wells was prepared. Three seismic lines were run to correlate the instrument results with the geologic logs of nearby observation wells. A proposed soil moisture measurement network was designed for the Wilmot Creek sub-basin on the basis of topography, soil type and land use. Satellite stations were proposed for the other two sub-basins.

One main climatological station and three satellite stations were installed in co-operation with the Meteorological Branch. Five Sacramento storage precipitation gauges were measured regularly by Branch members. Twelve snow courses were measured six times during the winter months and Preliminary Data Report No. 67-1, entitled "Snow Survey Report - Wilmot Creek Basin 1966-67", was prepared and distributed. Statistical analyses of the snow course data were carried out to determine the best courses to be resampled.

Two field trips were undertaken in the basin. One trip was to acquaint new staff members with hydrometric installations and geologic conditions in the basin. The other was to familiarize members of the Junior Conservationists Awards Program, sponsored by the Conservation Authorities Branch, with some of the activities of the Division of Water Resources.

With the aid of two summer students, a water and land use study was completed. All watercourses were traversed and 1220 interviews with local residents were completed.

East & Middle Oakville Creeks

Thirteen sets of streamflow measurements were undertaken at four stations to establish rating curves. In conjunction with the streamflow measurements, six sets of water samples were taken for water quality analyses.

General maintenance work was carried out and data collected at the nine previously-installed observation wells. The elevation of one well was determined by precise levelling from an established bench mark.

An electrical resistivity study to determine the extent of a buried sand and gravel formation was initiated in order to provide ground resistivity control for an air-borne resistivity survey proposed for the area by the Geological Survey of Canada. As part of this study, a map showing the location of water wells was prepared to provide geologic ground control.

One main climatological station and eight satellite stations were installed in co-operation with the Meteorological Branch.

Proposed snow survey sites were selected in preparation for measurements during the winter of 1967/68.

Venison Creek

On Venison Creek, eleven sets of streamflow measurements were made at three stations. Samples for water quality determinations were taken seven times in conjunction with the streamflow metering surveys.

General maintenance work was carried out at the seven observation wells in the basin and the data from the wells were collected and compiled.

One main climatological station and five satellite stations were installed and put into operation in the basin in co-operation with the Meteorological Branch.

Wilton Creek

The installation of observation wells was commenced and by the end of the year eight wells had been completed. Four of the large-diameter wells were electric-logged and two were equipped with automatic recorders.

Two main climatological stations and six satellite stations were installed in the basin in co-operation with the Meteorological Branch.

Experimental Basin Studies

Due to staff limitations, very little progress was made with experimental basin studies this year. Limited office studies were continued to assess the requirements of experimental basins and preliminary discussions were held with representatives of the Department of Lands and Forests to assess the feasibility of establishing parts of Wilmot Creek as an experimental basin.

Geophysical Investigations

In addition to the work in the representative basins geophysical studies were undertaken in support of programs of the Division and other agencies.

The electric well logger was operated in a deep well on Manitoulin Island to assist in the assessment of geologic formations at the request of the Drilling & Production Branch, Department of Energy and Resources Management.

Seismic studies were carried out in the Sudbury Basin area, at Bruce Mines and at Thornbury in support of proposed test-drilling projects to be undertaken by the Surveys and Projects Branch.

Electrical resistivity studies were carried out in conjunction with the seismic survey at Thornbury.

A demonstration of geophysical techniques was given as a field-laboratory study to students at the University of Guelph.

Special Studies

Sieve analyses were carried out on 110 samples submitted by the Hydrologic Data and Surveys and Projects branches.

TABLE 7 – SUMMARY OF HYDROMETRIC STATIONS OPERATED BY THE RIVER BASIN RESEARCH
BRANCH IN REPRESENTATIVE BASINS

BASIN	METEOROLOGICAL STATIONS		SNOW COURSES	STREAMFLOW GAUGING STATIONS		OBSERVATION WELLS		SOIL MOISTURE STATIONS
	MAIN	SATELLITE		Recording	Manual	Recording	Manual	
Blue Springs Creek	—	—	—	—	5	5	11	—
Bowmanville, Soper & Wilmot Creeks	2	17	12	12	2	10	11	6
East & Middle Oakville Creeks	1	8	—	4	—	2	7	—
Venison Creek	1	5	—	3	—	4	3	—
Wilton Creek	2	6	—	—	—	4	4	—
TOTALS	6	36	12	19	7	25	36	6

